

School of Psychology and Speech Pathology

Alcohol consumption and pre-drinking in Australian undergraduates

Kimberley Mitchell Caudwell

This thesis is presented for the Degree of

Doctor of Philosophy

of

Curtin University

January 2017

Declaration

To the best of my knowledge and belief, this thesis contains no material previously published by any other person except where due acknowledgement has been made. This thesis contains no material which has been accepted for the award of any other degree or diploma in any university.

Human Ethics. The research presented and reported in this thesis was conducted in accordance with the National Health and Medical Research Council National Statement on Ethical Conduct in Human Research (2007) – updated March 2014. The proposed research studies (detailed in Chapters II through VI) received human research ethics approval from the Curtin University Human Research Ethics Committee (EC00262), with the approval numbers as follows: Psych & SP 2012-11; PSYCH SP 2013-55; HR 185/2014. The intervention (detailed in Chapters V and VI) was also registered on the Australian and New Zealand Clinical Trials Registry (ANZCTR), and was assigned the following identification number: 12614001102662. Further detail on the trial can be found at <https://www.anzctr.org.au/>.

Signature: 

Date: 20 January 2017

Abstract

Background and study aims: *Pre-drinking* refers to the practice of consuming alcohol prior to attending a subsequent event, or ‘going out’, where alcohol consumption often continues. Individuals who pre-drink tend to consume more alcohol on drinking occasions, and are at greater risk of experiencing alcohol-related harm, relative to those who do not pre-drink on that occasion, making pre-drinking an important public health issue that likely contributes to the burden on health services. The purpose of this research was to develop a better understanding of the pre-drinking through the application of health behavioural models drawing on psychological theories of motivation and social cognition, how the components in these models predict pre-drinking behaviour, and to develop an online intervention to reduce pre-drinking alcohol consumption, based on behaviour change techniques (i.e., autonomy support, implementation intentions) from these component theories.

Methods/Design: Three studies were conducted to investigate the influential psychological constructs associated with pre-drinking behaviour. The first study used a prospective-correlational design to test a motivational sequence model based on the integration of *self-determination theory* and *theory of planned behaviour* to predict undergraduates’ intentions to engage in pre-drinking sessions at baseline, and their actual pre-drinking at follow-up, four weeks later. The second study used a dual-systems approach to measure the contribution of explicit pre-drinking motives and implicit alcohol identity to individuals’ typical pre-drinking alcohol consumption and experience of alcohol-related harm. The third study tested an integrated behaviour-change model in its predictions of individuals’ intentions to reduce alcohol consumption during pre-drinking sessions, and subsequent pre-drinking behaviour, using the same design as in the first study. These three studies informed the development of an online intervention based on behaviour change techniques drawing from multiple theoretical perspectives (i.e., the provision of autonomy support and formation of implementation intentions to reduce pre-drinking alcohol consumption). The intervention was then tested using a randomised controlled trial, in a 2 (autonomy support: yes/no) x 2 (implementation intentions: yes/no) design, with baseline measurement and intervention delivery, and follow-up measurement, four weeks later.

Results: The first study showed individuals exhibit strong positive attitudes based on their autonomous motivation to engage in pre-drinking behaviour, and that this was positively associated with their intentions to do so, however intentions were not strongly predictive of their pre-drinking behaviour. The second study showed positive relationships between

explicit motives and outcome measures, except situational control which was negatively associated with outcome measures; and that implicit alcohol identity was positively associated with alcohol-related harm, but not typical pre-drinking alcohol consumption. The third study found pre-drinking alcohol consumption was predicted by perceived behavioural control and implicit alcohol identity. The intervention was effective in reducing pre-drinking alcohol consumption and alcohol-related harm, however no interaction effects of the intervention conditions (i.e., autonomy support and implementation intentions) and time were observed.

Conclusions: This research shows that individuals form their attitudes consistent with their autonomous motivation to engage in pre-drinking behaviour, and to reduce alcohol consumption during pre-drinking sessions, however these constructs do not strongly relate to pre-drinking behaviour through intentional pathways. Instead, direct effects of perceived behavioural control and implicit alcohol identity on pre-drinking behaviour were observed, implicating the impulsive system and likely reflecting situational or contextual factors that precipitate pre-drinking. The intervention demonstrates that although the behaviour change techniques that comprised the intervention did not influence reductions in pre-drinking alcohol consumption and alcohol-related harm, the reduction in the outcome measures in all groups over time suggests that the content common to all intervention conditions (i.e., assessment, provision of information on recommended limits for alcohol consumption, and delivery of SMS messages that reiterate these limits) may have been sufficient to elicit behaviour change.

Acknowledgements

I would like to acknowledge the Whadjuk Noongar people, their Elders past and present, on whose traditional lands I have learned and grown throughout my time at Curtin University.

I would like to thank Prof. Martin Hagger, for his encouragement to pursue this project, and for letting me draw upon his wealth of experience and wisdom throughout. I would also like to thank A/Prof. Barbara Mullan for your sage advice and support throughout this project.

Thanks must also go to the people I have met along the way. To David Keatley, and Derwin Chan, for being mentors and friends. To the students at the HDR “hub” for their camaraderie, and to several of the staff in the School of Psychology and Faculty of Health Sciences, thank you for your support.

To Daniel: thank you for always believing in me. To Mum: thank you for your unwavering loyalty. To Dad: thank you for encouraging me to reach my potential. To my close friends and extended family – thanks for supporting me, and for your attempts to understand the ‘life academic’.

Finally, to Jaime. Thank you for being you.

List of publications included as part of this thesis

Caudwell, K. M., & Hagger, M. S. (2015). Predicting alcohol pre-drinking in Australian undergraduate students using an integrated theoretical model. *Applied Psychology: Health and Well-Being*, 7(2), 188-213. doi:10.1111/aphw.12044

Caudwell, K. M., & Hagger, M. S. (2014). Pre-drinking and alcohol-related harm in undergraduates: the influence of explicit motives and implicit alcohol identity. *Journal of Behavioral Medicine*, 37(6), 1252-1262. doi:10.1007/s10865-014-9573-6

Caudwell, K. M., Mullan, B. A., & Hagger, M. S. (2016). Combining motivational and volitional approaches to reducing excessive alcohol consumption in pre-drinkers: a theory-based intervention protocol. *BMC Public Health*, 16(45), 1-12. doi:10.1186/s12889-015-2648-7

Copyright Statement

I warrant that I have obtained, where necessary, permission from the copyright owners to use any third-party copyright material reproduced in the thesis (e.g. questionnaires, artwork, unpublished letters), or to use any of my own published work (e.g. journal articles) in which the copyright is held by another party (e.g. publisher, co-author).

Statement of author contribution

The nature and extent of the intellectual input by the candidate and co-authors has been validated by all authors, and can be found in the appendices.



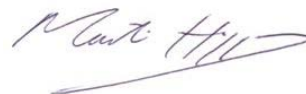
Kim M. Caudwell

Student



Barbara A. Mullan

Supervisor



Martin S. Hagger

Supervisor

**List of additional publications by the candidate relevant to the thesis but not forming
part of it**

Conference Proceedings

- Caudwell, K. M., & Hagger, M. S. (2014). Thinking about pre-drinking: Predicting alcohol pre-drinking in Australian undergraduates using an integrated theoretical model. In E. J. Kothe (Chair) *Prediction and Intervention for Risky Alcohol Consumption Behaviours*. Symposium conducted at the Australasian Society of Health and Behavioural Medicine 11th Annual Proceedings, Auckland, New Zealand.
- Caudwell, K. M., & Hagger, M. S. (2014). Predicting pre-drinking alcohol consumption using a dual-systems approach. Poster session presented at the Australasian Professional Society on Alcohol and other Drugs Conference 2014, Adelaide, South Australia
- Caudwell, K. M., Mullan, B. A., & Hagger, M. S., (2015). Combining motivational and volitional approaches to reducing pre-drinking alcohol consumption and alcohol-related harm: An online psychological theory-based intervention. Paper presented at the 12th INEBRIA Conference, Atlanta, GA, USA.
- Caudwell, K. M., & Hagger, M. S. (2015). Predicting pre-drinking in Australian undergraduate students: Applying an integrated model of behaviour. Paper presented at the Australasian Professional Society on Alcohol and other Drugs Conference, 2015, Perth, Western Australia.

Publications:

- Keatley, D. A., Chan, D. K. C., Caudwell, K. M., Chatzisarantis, N. L. D., & Hagger, M. S. (2014). A consideration of what is meant by automaticity and better ways to measure it. *Frontiers in Psychology*, 5, 1537. doi:10.3389/fpsyg.2014.01537

TABLE OF CONTENTS

Alcohol consumption and pre-drinking in Australian undergraduates	1
Declaration.....	2
Abstract.....	3
Acknowledgements	5
List of publications included as part of this thesis	6
Copyright Statement.....	6
Statement of author contribution.....	7
List of additional publications by the candidate relevant to the thesis but not forming part of it.....	8
Conference Proceedings	8
Publications:.....	8
TABLE OF CONTENTS	9
CHAPTER I: ALCOHOL CONSUMPTION AND UNIVERSITY STUDENTS: A BRIEF REVIEW.....	13
Excessive alcohol consumption and alcohol-related harm	13
Prevalence of alcohol consumption in university students.....	14
Pre-drinking as an emergent excessive alcohol consumption behaviour	14
Pre-drinking alcohol consumption and alcohol-related harm	16
Applying theories of health behaviour to pre-drinking	16
Self-determination theory	17
The theory of planned behaviour.....	19

CONTENTS	10
Theoretical integration.....	19
Post-intentional considerations.....	21
An integrated behaviour change model.....	23
The present research	24
CHAPTER II: PREDICTING ALCOHOL PRE-DRINKING IN AUSTRALIAN UNDERGRADUATE STUDENTS USING AN INTEGRATED THEORETICAL MODEL	26
CHAPTER III: PRE-DRINKING AND ALCOHOL-RELATED HARM IN UNDERGRADUATES: THE INFLUENCE OF EXPLICIT MOTIVES AND IMPLICIT ALCOHOL IDENTITY	69
CHAPTER IV: REDUCING ALCOHOL CONSUMPTION DURING PRE-DRINKING SESSIONS: TESTING AN INTEGRATED BEHAVIOUR-CHANGE MODEL	103
Introduction.....	106
Method	109
Participants	109
Measures.....	110
Analytic Method.....	112
Results.....	114
Preliminary analyses.....	114
Model evaluation	115
Path coefficients	115
Mediation analyses	116

Discussion	117
Strengths, Limitations, and Future Research Directions	120
Conclusion	122
CHAPTER V: COMBINING MOTIVATIONAL AND VOLITIONAL APPROACHES TO REDUCING EXCESSIVE ALCOHOL CONSUMPTION IN PRE-DRINKERS: A THEORY-BASED INTERVENTION PROTOCOL	136
CHAPTER VI: TESTING AN ONLINE, THEORY-BASED INTERVENTION TO REDUCE PRE-DRINKING ALCOHOL CONSUMPTION AND ALCOHOL- RELATED HARM IN UNDERGRADUATES: A RANDOMISED CONTROLLED TRIAL.....	149
Introduction	152
Motivational Approaches to Behaviour Change	152
Volitional Approaches to Behaviour Change.....	153
The Present Study.....	155
Methods	156
Design and Procedure.....	156
Participants	157
Measures.....	158
Results.....	160
Preliminary analyses.....	160
Main analyses	162
Discussion.....	163

CONTENTS	12
Strengths, limitations, and future directions	166
Conclusion	168
CHAPTER VII: GENERAL SUMMARY AND DISCUSSION	180
Summary of findings	180
Implications for understanding the influences underlying pre-drinking	183
Implications for health behavioural theory.....	187
Limitations and future research directions.....	191
Conclusions	193
Bibliography	195
APPENDIX A: STATEMENT OF CONTRIBUTION BY OTHERS	231
APPENDIX B: RIGHTSLINK PRINTABLE LICENCE (CHAPTER II)	233
APPENDIX C: RIGHTSLINK PRINTABLE LICENCE (CHAPTER III)	239
APPENDIX D: LIST OF MEASURES INCLUDED IN CHAPTER IV	244
APPENDIX E: ADDITIONAL ANALYSES FOR CHAPTER IV	253
APPENDIX F: CREATIVE COMMONS AGREEMENT (CHAPTER V).....	255
APPENDIX G: MEASURES IN CHAPTER VI.....	259
APPENDIX G: ITT ANALYSES (CHAPTER VI).....	266
APPENDIX I: EVIDENCE OF ACCEPTANCE OF CONFERENCE PRESENTATIONS.....	267

CHAPTER I: ALCOHOL CONSUMPTION AND UNIVERSITY STUDENTS: A BRIEF REVIEW

Excessive alcohol consumption and alcohol-related harm

Alcohol is widely consumed throughout the world, however excessive alcohol consumption is linked to a range of health issues worldwide. The World Health Organisation (2014) estimated that in 2012, 3.3 million deaths, and 139 million disability-adjusted life years, were attributable to alcohol consumption. Typically, alcohol-related harm is referred to in terms of short-term harm, related to drinking to intoxication (e.g., road accidents, violence, injury); and long-term harm, related to the consumption of alcohol over the lifespan (e.g., liver and cardiovascular disease, mental illness, cancer; World Health Organization, 2000). Tangible costs related to alcohol-related harm in Australia each year (e.g., hospitalisation, accidents, assaults, problematic drinking) have been estimated to be AUS\$14.2 billion (Laslett et al., 2014), and are thought to exceed the revenue collected from the sale of alcohol by two to one (Manning, Smith, & Mazerolle, 2013). In terms of secondary alcohol-related harm (i.e., harm caused by others' drinking), an Australian national survey by Laslett et al. (2011) found 70% of respondents reported being negatively affected by a stranger's alcohol consumption, and 30% by the alcohol consumption of someone known to them.

Given the risks associated with excess alcohol consumption, the Australian National Health and Medical Research Council (NHMRC) has established guidelines to reduce the risk of alcohol-related harm over a lifetime (i.e., drinking no more than two standard drinks¹ on any day), and on a single occasion (i.e., drinking no more than four standard drinks on a single occasion). Other countries have adopted similar guidelines, based on limiting alcohol consumption to a specific number of units to reduce the risk of harm in the short- and long-term (Guenther, Ding, & Rimm, 2013; National Health Service, 2015). Research indicates that alcohol consumption guidelines may not be overly effective if people are not familiar with them, cannot relate them to their own alcohol consumption (i.e., alcohol consumed in standard drink equivalents), or consider them incongruent with their perceptions and experiences of harmful alcohol consumption (Australian Institute of Health and Welfare, 2014; de Visser & Birch, 2012; Furtwaengler & Visser, 2013; Livingston, 2012)..

¹What constitutes a standard drink (i.e., a beverage containing a fixed amount of alcohol) varies greatly between countries (Bloomfield, Stockwell, Gmel, & Rehn, 2003). In Australia, a standard drink contains 10g of ethanol, equivalent to 12.5mL pure alcohol. According to the National Health and Medical Research Council, a 375mL serving of mid-strength beer (3.5% ABV), a 100mL serving of wine (11.5-13.5% ABV), and a 30mL serving of spirits (40% ABV), are all examples of a standard drink (National Health and Medical Research Council, 2009).

Prevalence of alcohol consumption in university students

Lack of knowledge or apathy about low-risk alcohol consumption may be especially prominent in student populations in college and university settings. University students vary greatly in their estimates of the alcohol content of a standard drink, and the low-risk guidelines introduced by the NHMRC, presenting “a picture of a demographic group that is largely ignorant of the substantial harm they expose themselves to when drinking” (Hasking, Shortell, & Machalek, 2005, p. 106). College and university students around the world have been shown to consume more alcohol on drinking occasions than their non-student peers, placing them at increased risk of alcohol-related harm (Karam, Kypri, & Salamoun, 2007; Kypri, Cronin, & Wright, 2005; Slutske et al., 2004). Australian university students have referred to an ‘inescapable culture’ of excessive alcohol consumption that permeates the university experience, related to the perceived social benefits of drinking (Hallett, McManus, Maycock, Smith, & Howat, 2014). In terms of prevalence, alcohol consumption, ninety per cent of Australian university students reported consuming alcohol in the previous 12 months, with over a third of these meeting criteria for hazardous drinking (Hallett et al., 2012). In terms of secondary alcohol-related harm, 13% of this sample reported being insulted, humiliated, or having their studies disturbed by drinkers, with 6% reporting assault, in the previous month (Hallett et al., 2012). Students commonly report experiencing hangovers as a result of their drinking, as well as passing out, engaging in or experiencing arguments, vomiting, and drink driving (Hallett, Howat, et al., 2014). A quarter of students report missing class, or being unable to concentrate in the classroom, due to their alcohol consumption, with nearly half reporting the belief that their alcohol consumption was negatively impacting their academic performance (Hallett, Howat, et al., 2014). Recent research has found high-risk drinkers reported experiencing significantly higher alcohol-related harm, and academic problems, and more strongly endorsed alcohol expectancies, than low-risk drinkers (Burns et al., 2015).

Pre-drinking as an emergent excessive alcohol consumption behaviour

Pre-drinking refers to the practice of consuming alcohol prior to attending a subsequent event, where alcohol consumption continues (Pedersen & LaBrie, 2007). Terms such as *preloading* (Foster & Ferguson, 2013), *prepartying* (Pedersen & LaBrie, 2007), and *pregaming* (Borsari et al., 2007) appear consistent in referring to the consumption of alcohol at a home or otherwise private event, prior to ‘going out’, usually on a given evening (Foster & Ferguson, 2013). Other “loading” behaviours have been described as occurring during and

following events (Forsyth, 2010; O'Rourke, Ferris, & Devaney, 2015). Pre-drinking is highly prevalent in university and college students (DeJong, DeRicco, & Schneider, 2010; Pedersen & LaBrie, 2007). Burns et al. (2015) found that the majority (85.20%) of university students classified as hazardous drinkers reported pre-drinking at least once a month, with over half of these students reporting consuming five or more standard drinks during their most recent pre-drinking session, exceeding the NHMRC guidelines to reduce the risk of alcohol-related harm on a drinking occasion (Burns et al., 2015).

Pre-drinking is thought to have emerged as an unintended consequence of increased scrutiny on alcohol supply in licensed venues, effectively displacing patrons to private residences where they can consume alcohol in excess (Wells, Graham, & Purcell, 2009a). Researchers have also developed psychometric scales that tap into a range of practical and social elements associated with pre-drinking (Bachrach, Merrill, Bytschkow, & Read, 2012; LaBrie, Hummer, Pedersen, Lac, & Chithambo, 2012). The *prepartying motives inventory* (LaBrie et al., 2012) has demonstrated discriminant validity, in that pre-drinking motives were distinct from general drinking motives (i.e., Cooper, 1994), and demonstrated criterion validity in predicting pre-drinking alcohol consumption and frequency. *Interpersonal enhancement* (e.g., pre-drinking to facilitate enjoyment, interactions) was found to be a key motive dimension related to pre-drinking (LaBrie et al., 2012), which is consistent with reports of the convenience or relative ease of socialising at friends' houses prior to entering noisy or crowded pubs or nightclubs (Forsyth, 2010). Similarly, the *situational control* motive reflects pre-drinking as being conducive to consuming alcohol in a safe and controlled environment (Barton & Husk, 2014). Students report that heavy drinking tends to be acceptable in a home environment, among trusted friends (Hallett, McManus, et al., 2014), and alcohol consumption appears to vary based on the nature of the pre-drinking scenario (MacLean & Callinan, 2013).

One aspect of pre-drinking not represented by the prepartying motives dimension of LaBrie et al (2012) relates to the price of alcohol, in that alcohol purchased at a liquor store or off-premise outlet is often cheaper than that purchased in a bar or club (Barton & Husk, 2014; O'Rourke et al., 2015). This is especially relevant to university students, who are often confined to tight budgets (Bexley, Daroesman, Arkoudis, & James, 2013), and are motivated to maximise their alcohol consumption at the lowest possible price (Hallett, McManus, et al., 2014). Miller and Droste (2013) have shown that in a hypothetical alcohol purchase and consumption scenario, university students unanimously endorsed consuming greater than four

standard drinks at the lowest price per-standard drink (i.e., \$1-3), with a decline in the endorsement as the price per-standard drink increases (i.e., >\$3), illustrating how price considerations influence alcohol consumption. Pre-drinkers also report being primarily motivated by cost when asked about their pre-drinking in qualitative studies (MacLean & Callinan, 2013; Pedersen, LaBrie, & Kilmer, 2009).

Pre-drinking alcohol consumption and alcohol-related harm

Recent research has demonstrated the risks associated with pre-drinking. Event-level analyses have shown that pre-drinkers are more likely to consume more alcohol, have higher blood alcohol concentrations, and report greater experience of alcohol-related harm, than those who do not pre-drink on a given drinking occasion (Barry, Stellefson, Piazza-Gardner, Chaney, & Dodd, 2013; Labhart, Graham, Wells, & Kuntsche, 2013; LaBrie & Pedersen, 2008; Merrill, Vermont, Bachrach, & Read, 2013; Østergaard & Skov, 2014). Pre-drinking is also quite prevalent in hazardous drinkers (Barry et al., 2013). Kuntsche, Otten, & Labhart (2015) found that when pre-drinking, individuals were three times more likely to consume alcohol at a greater pace than when drinking in licensed premises, which may in part explain the increased level of intoxication and experience of alcohol-related harm relative to non-pre-drinkers. Whether or not an individual has engaged in pre-drinking on a given drinking occasion predicts unique variance in blood alcohol concentration, after controlling for gender, age, student status, and ethnicity (Barry et al., 2013). Pre-drinking appears to be influenced greatly by the social composition of the pre-drinking environment. For example, Wells et al. (2015) found pre-drinkers from larger pre-drinking groups had higher blood alcohol concentrations than those pre-drinking in smaller groups. Kuntsche et al. (2015) found that male pre-drinkers were more likely to consume more alcohol when pre-drinking with friends, and women tended to consume less alcohol when pre-drinking with opposite-sex friends.

Applying theories of health behaviour to pre-drinking

While it has been argued that pre-drinking is simply excessive alcohol consumption in a different setting (Room & Livingston, 2009), evidence suggests that pre-drinking can be considered a distinct alcohol consumption behaviour, with relatively specific motives and unique contributions to the experience of alcohol-related harm (Kuntsche & Labhart, 2013; LaBrie et al., 2012; Miller et al., 2015; Wells, Graham, & Purcell, 2009b). In terms of public health strategies to target pre-drinking, factors such as the cheaper cost of retail-purchased alcohol, and individuals' desire to become intoxicated, may be difficult to address at the

legislative or public health policy level (Wardle, 2015). Indeed, there is an indication that similar strategies aimed at reducing excessive alcohol consumption in licensed premises may have contributed to the popularity of pre-drinking, leading to a ‘home-pub-club’ pattern of alcohol consumption (Barton & Husk, 2012; Wells et al., 2009a). The often-discussed strategy to reduce heavy patterns of alcohol consumption by increasing the taxation on alcoholic beverages (e.g., through volumetric taxation or minimum pricing schemes) are unlikely to be supported by the alcohol industry and general public (Byrnes, Cobiac, Doran, Vos, & Shakeshaft, 2010; Lonsdale, Hardcastle, & Hagger, 2012). As such, interventions that attempt to change behaviour at the individual level may be necessary to reduce the risks associated with pre-drinking (Kuntsche et al., 2015; Pedersen, 2016).

Many individual-level interventions that attempt to change behaviour are based on psychological theories that posit various constructs such as motivation and social cognitive constructs as contributing to behavioural engagement. These theories can be applied to examine what leads individuals to engage in deleterious health behaviours, such as excessive alcohol consumption, and what leads individuals to engage in pro-health behaviours, such as reducing alcohol consumption, or keeping it within recommended limits (Cooke, Dahdah, Norman, & French, 2014; French & Cooke, 2012; McEachan, Conner, Taylor, & Lawton, 2011; Ryan, Patrick, Deci, & Williams, 2008). Once identified, these influential theoretical constructs can be targeted in interventions by adopting specific behaviour change techniques that attempt to elicit change in the constructs (Michie & Johnston, 2012). Two prominent theories that have been applied to understand health behaviour and inform interventions in this way are self-determination theory (Deci & Ryan, 1985b), and the theory of planned behaviour (Ajzen, 1991). These theories and their application to pre-drinking behaviour will be outlined in the next section.

Self-determination theory

Self-determination theory (Deci & Ryan, 1985b) is a humanistic theory of human motivation and behaviour and aims to identify the underlying reasons that lead individuals to act in certain contexts. A central tenet of self-determination theory concerns the types of motivation that individuals experience, thought to exist on a continuum from *controlled motivation*, the least-self-determined form of motivation, to *autonomous motivation*, the most self-determined (Deci & Ryan, 2000). Controlled motivation subsumes more extrinsic, or external rationales for behavioural engagement (e.g., financial incentive), including rationales for acting that are based on self-esteem (e.g., avoiding guilt, blame, or embarrassment).

Conversely, autonomous motivation subsumes rationales for behavioural engagement that are more internalised – where the individual values the benefits of engaging in the behaviour, or the behaviour itself is inherently rewarding or pleasing. Research has shown that controlled and autonomous motivation differ in how they influence a range of behaviours. Controlled motivation influences behaviour to the extent that the external contingencies upon which it is based remain, autonomous motivation leads individuals to continue engaging in the behaviour, as it forms an integral part of their identity, or contributes to the attainment of personally-relevant goals (Deci & Ryan, 1985b; Vansteenkiste, Simons, Lens, Sheldon, & Deci, 2004). The relationships between controlled and autonomous motivation have been supported in a range of health behaviour contexts (Ng et al., 2012).

Self-determination theory has been widely applied in a range of health behavioural settings, including alcohol consumption (Ng et al., 2012). Some of this work has focused on the motivational orientation of individuals - their dispositional tendencies to evaluate situations in a controlled or autonomy-oriented manner, based on experience (Deci & Ryan, 1985a). For example, Neighbors et al. (2004) found that the effect of controlled orientation on alcohol consumption in college students was mediated by contingent self-esteem. This suggests that students that are influenced by norms in social drinking situations are more likely to use alcohol, because their self-worth is ‘tied in’ with the social group, leading them to feel pressure to conform to these norms. Following a normative feedback intervention (i.e., which attempts to modify normative perceptions of alcohol consumption), college students that were more control-oriented reported fewer negative alcohol consequences at follow-up (Neighbors, Lewis, Bergstrom, & Larimer, 2006). Knee and Neighbors (2002) also found support for a model in which controlled orientation predicted extrinsic reasons for consuming alcohol, peer pressure to consume alcohol, and alcohol consumption behaviour. These studies, while informative, focus exclusively on relationships between generalized motivational orientations, and extrinsic proximal reasons for consuming alcohol, and have not incorporated intrinsic reasons for engaging for reducing alcohol consumption.² Therefore, the application of self-determination theory to pre-drinking may examine whether specific controlled and autonomous motives influence participation in pre-drinking and reducing alcohol consumption during pre-drinking sessions.

²For example, research by Hagger et al. (2011) has shown that identified regulation (i.e., a component of autonomous motivation) framed in terms of reducing alcohol consumption was associated with lower alcohol consumption at follow-up, in a sample of company employees.

The theory of planned behaviour

The theory of planned behaviour (Ajzen, 1991) is a social cognitive theory that has been widely applied throughout various disciplines as a means of understanding behavioural *intention* - the sum total of all motivational elements reflecting behavioural engagement – and its relation to behaviour. People's intentions are thought to be formed by three belief-based constructs: their *attitude* toward engaging in the target behaviour; the *subjective norm* regarding the behaviour (i.e., perceived social influences to engage in the behaviour); and *perceived behavioural control* over engaging in behaviour. Attitude, subjective norm, and perceived behavioural control, influence behaviour through intention, with perceived behavioural control directly influencing behaviour, where it serves as a proxy measure for actual control (Ajzen, 1991). The posited relationships between these constructs, and their relationship with behaviour, has been demonstrated in meta-analyses (Armitage & Conner, 2001; McEachan et al., 2011). The theory of planned behaviour has often been applied to alcohol consumption, with meta-analytic evidence showing medium-to-large effects between constructs and behaviour, directing researchers to target attitudes, subjective norms, and self-efficacy (i.e., a component of perceived behavioural control) related to alcohol consumption in interventions (Cooke et al., 2014). However, other patterns of consumption such as pre-drinking have not been investigated (Cooke et al., 2014). Applying the theory of planned behaviour to pre-drinking can ascertain whether these observed relationships hold for pre-drinking, and can be used to inform intervention development.

Theoretical integration

A limitation of self-determination theory is that while it is important to understand the motivational basis for certain behaviours, precisely *how* different motivational orientations precede behaviour is not well accounted for. Similarly, a limitation of the theory of planned behaviour is that it does not provide a comprehensive framework to explain how individuals *form* their belief-based evaluations (i.e., attitude, subjective norm, perceived behavioural control) that underpin intention. Self-determination theory views the effects from controlled and autonomous motivation as mutually exclusive (Deci & Ryan, 2000), whereas in the theory of planned behaviour, individuals may hold beliefs that may be facilitative of participation in a given behaviour (e.g., because the behaviour is viewed as leading to a highly valued outcome) or undermine it (e.g., the behaviour is believed to lead to negative or detrimental outcomes). An individual may, therefore, exhibit motivational orientations with respect to a given behaviour (e.g., pre-drinking) from the perspective of self-determination

theory, yet hold beliefs that may be both facilitative or debilitating with respect to their intentions to engage in pre-drinking behaviour. Self-determination theory and the theory of planned behaviour are therefore considered to provide complementary accounts of behaviour, a suggested criteria underlying the integration of psychological theories (Hagger, 2009). By integrating self-determination theory and the theory of planned behaviour, the respective limitations inherent to each theory can be overcome through the formation of a comprehensive framework, whereby motivational orientations influence belief-based evaluations of behaviour that shape intentions to act (Hagger & Chatzisarantis, 2009). For example, an individual may feel that reducing pre-drinking alcohol consumption is an important thing to do (autonomous motivation), believe that reducing pre-drinking alcohol consumption in the future would be beneficial (attitude), and this will lead them to form intentions to reduce their pre-drinking alcohol consumption. Conversely, an individual may feel compelled to reduce their pre-drinking alcohol consumption due to external pressures (controlled motivation), which may influence their perceptions of social influence to do so in the future (subjective norm), which influence their intentions.

Not only does theoretical integration in this context allow for a more comprehensive explanation of the basis of intention formation, but, importantly, it allows for behaviour change interventions to be developed based on prescribed techniques from component theories. Similarly, isolating the constructs that mediate the effect of motivational orientation on behaviour (i.e., attitude, subjective norm, perceived behavioural control, intention) is important, as it allows for the targeting of these mediators to facilitate the success of behaviour change interventions (e.g., French & Cooke, 2012). For instance, meta-analyses demonstrate that changes in constructs from the theory of planned behaviour are related to modest changes in behaviour, and when delivered online, interventions based on the theory of planned behaviour-based show increased efficacy over those based on other theories (Sheeran et al., 2016; Webb, Joseph, Yardley, & Michie, 2010; Webb & Sheeran, 2006). However, despite the theory of planned behaviour being used extensively to determine the influential constructs that underpin behaviour, the theory does not prescribe formal methods or techniques to change these constructs (Michie, Johnston, Francis, Hardeman, & Eccles, 2008).

A key component of self-determination theory is that autonomous motivation occurs when the underlying behaviour is internalised – in other words, the process by which the individual develops intrinsic reasons for pursuing the behaviour. This process of

internalisation is facilitated by the provision of three basic psychological needs – autonomy, competence, and relatedness (Deci & Ryan, 2000). Autonomy is highly relevant to promoting health behaviours, such as smoking cessation and engaging in physical activity (Hagger, Chatzisarantis, Culverhouse, & Biddle, 2003; Williams & Deci, 2001; Williams, Deci, & Ryan, 1998; Williams et al., 2006), and can be supported through various communication styles and techniques (Su & Reeve, 2011). Likewise, undermining, or failing to support autonomy, can be detrimental to health behaviour change attempts (Pavey & Sparks, 2008, 2009, 2010). The relationships between these key concepts in self-determination theory and engaging in a range of health behaviours has been supported (Ng et al., 2012). Therefore, the integration of self-determination theory and the theory of planned behaviour allows for the motivational antecedents of intentions to be explored, and established techniques that facilitate autonomous motivation to be used, to promote health behaviour change (Hagger & Chatzisarantis, 2009).

Post-intentional considerations

A major limitation of motivational and social cognitive models is the discrepancy between an individual's intentions and their behaviour – the intention-behaviour gap - that has been observed in various contexts (Sheeran, 2002). Attempts have been made to bridge this gap by considering the individual's ability to exert control over, or regulate, their behaviour. Individuals with higher self-control, and those skilled at planning, are more likely to act in accordance with their intentions (Barbara Mullan, Wong, Allom, & Pack, 2011; Sniehotta, Scholz, & Schwarzer, 2005).

A similar line of research has made an important advancement in the prediction of various behaviours with the inclusion of psychological constructs that may operate outside of conscious or intentional control, termed impulsive processes (Strack & Deutsch, 2004). A reflective-impulsive model has been developed to account for the synergistic, or antagonistic, relationships between reflective (i.e., consciously-mediated) and impulsive (i.e., non-conscious) processes, referred to as a *dual systems* approach (Strack & Deutsch, 2004). Studies based on this approach primarily use reaction-time-based tasks to infer the operation of impulsive processes outside conscious awareness (Lindgren et al., 2012; Payne, Govorun, & Arbuckle, 2008). A commonly used measure that is thought to elicit these processes is the *implicit association test* (Greenwald, McGhee, & Schwartz, 1998), a computerised task which requires the participant to sort an array of words (e.g., *beer*, *drinker*) into their component 'theme' category (e.g., *alcohol*) as they appear on a computer screen, using

certain keys on a keyboard. Categories are paired (e.g., *alcohol + me*), on opposite sides of a computer screen with the response time discrepancy (or time-penalised erroneous responses) indicating a lagged response time bias towards certain word pairings. Conversely, shorter response time discrepancy indicates a preference for certain word pairings (i.e., they are sorted faster as the activation of the target category is more rapidly associated). A *D-score* is calculated following a computational algorithm that is analogous to Cohen's *d* – the magnitude of the difference between mean paired and unpaired response times, giving a positive or negative score indicative of the direction of the bias (e.g., *alcohol + me* versus *alcohol + not me*). Implicit alcohol identity has found to predict a range of alcohol-related behaviours and outcomes, and appears especially relevant to the alcohol consumption behaviour of university students, implicating the impulsive system in influencing alcohol consumption (Hofmann, Friese, & Wiers, 2008; Lindgren, Neighbors, Teachman, et al., 2016; Lindgren et al., 2012; Lindgren, Ramirez, Olin, & Neighbors, 2016; Ramirez, Dennhardt, Baldwin, Murphy, & Lindgren, 2016).

Given intention is a common target of health behaviour change interventions but does not always lead to behaviour, and that non-intentional processes may influence behaviour outside of conscious awareness, it may be prudent to focus on the *post-intentional* or *volitional* phase of behaviour (Heckhausen, 1991). Gollwitzer and Brandstätter (1997) have suggested that individuals fail to follow through on their intentions for various reasons, such as failing to recognise the opportunity to act, or failing to act a critical moment. Gollwitzer and Brandstätter (1987) suggest that *implementation intentions* can overcome such limitations by associating a goal-directed behaviour with an environmental or contextual cue that brings about the intended behavioural response. Implementation intentions can therefore be considered a planning technique in which individuals specify the 'when' and 'how' that intention will be carried out, and the subsequent linking of an environmental cue with the intended response makes the goal-directed behaviour more likely to occur. For example, the simple intention "I intend to reduce my alcohol consumption when pre-drinking" may not be sufficiently effective in bringing about behaviour change, whereas the implementation intention "If I finish an alcoholic beverage, I will then have a glass of water to reduce my alcohol consumption when pre-drinking." may be more effective, as the finishing of the beverage triggers the goal-directed response to limit alcohol consumption. Meta-analytic evidence for implementation intentions shows considerable effects on behaviour (Gollwitzer & Sheeran, 2006), and they are considered well-suited for behaviour change interventions

given their low response burden on participants (Hagger & Luszczynska, 2014).

Implementation intentions have seen some success in the context of reducing alcohol consumption in general and student populations (Armitage, 2009; Hagger et al., 2012). The formation of implementation intentions to reduce pre-drinking alcohol consumption may be an effective strategy to facilitate the transition of intentions to do so into corresponding behaviour. Additionally, there is evidence that providing autonomy support to individuals forming implementation intentions confers a bolstering effect, as the self-concordance of a goal is more likely to engender commitment to the overarching goal (Koestner et al., 2006; Koestner, Lekes, Powers, & Chicoine, 2002).

An integrated behaviour change model

Recently, Hagger and Chatzisarantis (2014) developed a comprehensive model for physical activity behaviour that extends the fundamental integrative proposition of self-determination theory and the theory of planned behaviour (i.e., that autonomous motivation influences intention through belief-based proximal predictors of intention) by incorporating post-intentional and implicit-level influences that are associated with health behaviour. In this model, action planning (i.e., specifying the how, when, and where an action will be taken) is thought to moderate the effect of intention on behaviour, given research indicating that planning is associated with greater likelihood that intentions will lead to behaviour (Norman & Conner, 2005; Sniehotta, Scholz, & Schwarzer, 2005). The model also accommodates non-conscious, or impulsive processes that influence behaviour, such as implicit attitudes and implicit motivation based on recent and historical accounts that identify dual pathways to action (see Hagger, 2016). This is an important inclusion, as impulsive processes are known to influence behaviour outside of intention, and are increasingly being considered as another integral element of health behaviour change interventions (Bartsch, Mullan, & Houben, 2014; Boffo, Pronk, Wiers, & Mannarini, 2015). Potentially, addressing post-intentional components of the behaviour change process could limit these influences by making cues to the intended action (e.g., reducing pre-drinking alcohol consumption) more salient (Adriaanse, Gollwitzer, De Ridder, De Wit, & Kroese, 2011). By applying the integrated behaviour change model to pre-drinking, a comprehensive framework of the influential routes to behaviour, and targets of an intervention, can be ascertained (see Figure 1).

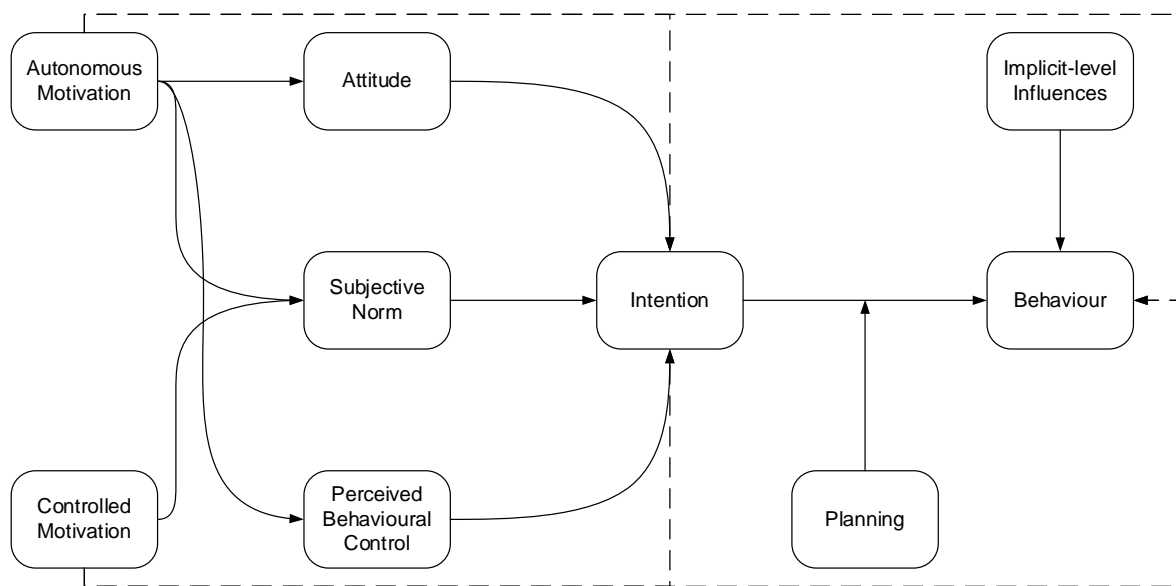


Figure 1. The integrated behaviour change model (adapted from Hagger & Chatzisarantis, 2014). Note that the implicit associations and implicit motivation are subsumed by the term implicit-level influences. Dashed lines represent paths which are posited to be mediated by other constructs. The effect of past behaviour is omitted for clarity.

The present research

The main aims of the present research programme were: (1) to develop a better understanding of the motivational, social cognitive, and impulsive theory-based antecedents of pre-drinking behaviour in university students; (2) to investigate how these antecedents operate in relation to each other to predict pre-drinking using an integrated theoretical model, and; (3) to develop an intervention based on the findings of that research. The current chapter (I) provided a review of literature related to alcohol consumption and alcohol-related harm, pre-drinking, in relation to university students. Chapter II outlines a prospective-correlational study using a motivational sequence model based on self-determination theory and the theory of planned behaviour to predict students' intentions to engage in pre-drinking sessions, and their behaviour in terms of engaging in pre-drinking sessions. Chapter III details a second cross-sectional study which used a recently-developed and validated measure of pre-drinking motives (LaBrie et al., 2012) and a version of the implicit association test (i.e., implicit alcohol identity; Lindgren et al., 2012) to predict typical pre-drinking alcohol consumption and the experience of alcohol-related harm. Chapter IV builds on the findings of studies presented in Chapters II and III to apply an integrated behaviour change model, incorporating planning and implicit-level constructs, to students' pre-drinking alcohol consumption

reduction intentions and behaviour, to inform an intervention. Chapter V is the published protocol paper that details an online, theory-based intervention to reduce pre-drinking alcohol consumption and related harm in undergraduate students. The intervention draws from previous research, as well as perspectives of self-determination theory and action phases, to target both motivational and volitional phases of action with potentially synergistic effects. An online intervention was particularly suited to this population as they do not tend to present to conventional, face-to-face health practitioners to address alcohol consumption (Kypri, Saunders, & Gallagher, 2003), and that online interventions based on theory of planned behaviour appear especially efficacious. Chapter VI presents the findings of the intervention detailed in the protocol, delivered online to university students. Chapter VII presents a general summary and discussion of the presented programme of research, and a conclusion.

**CHAPTER II: PREDICTING ALCOHOL PRE-DRINKING IN AUSTRALIAN
UNDERGRADUATE STUDENTS USING AN INTEGRATED THEORETICAL
MODEL**

This is the accepted version of the following article: Caudwell, K. M., & Hagger, M. S. (2015). Predicting alcohol pre-drinking in Australian undergraduate students using an integrated theoretical model. *Applied Psychology: Health and Well-Being*, 7(2), 188-213. doi:10.1111/aphw.12044, which has been published in final form at <http://dx.doi.org/10.1111/aphw.12044>

Predicting alcohol pre-drinking in Australian undergraduate students using an integrated
theoretical model

Kim M. Caudwell*, Martin S. Hagger

Health Psychology and Behavioural Medicine Research Group, School of Psychology and
Speech Pathology, Curtin University, Bentley WA 6530, Australia

*Address for correspondence: Kim Caudwell, Health Psychology and Behavioral Medicine
Research Group, School of Psychology and Speech Pathology, Curtin University, Bentley
WA 6152. Email: kim.caudwell@postgrad.curtin.edu.au

Abstract

Background: The aim of the present study was to examine the social-cognitive and motivational factors associated with pre-drinking based on a model integrating motivational constructs from self-determination theory and belief-based constructs from the theory of planned behaviour.

Methods: A prospective correlational design was used. Participants ($N = 286$; 66.4% female) completed self-report measures of past alcohol consumption, autonomous and controlled forms of motivation from self-determination theory, and attitudes, subjective norms, perceived behavioural control, and behavioural intentions from the theory of planned behaviour at baseline. Participants reported pre-drinking frequency four weeks later.

Results: Variance-based structural equation modeling showed that the hypothesized model predicted 54% of the variance in pre-drinking intentions at baseline, and 20% of the variance in pre-drinking behaviour at follow-up. Mediation analyses indicated strong, statistically-significant effects of autonomous motivation on intentions to pre-drink, partially mediated by attitudes and subjective norms. Intention and perceived behavioural control significantly predicted pre-drinking frequency.

Conclusions: Results provide support for the hypothesized model relationships. Autonomous motivation, attitude, subjective norm, and perceived behavioural control were influential in forming students' intentions to pre-drink. However, consistent with previous findings, the intention-behaviour relationship was relatively weak. Future research should look to non-intentional and volitional processes that may influence pre-drinking in undergraduates.

Keywords: pre-drinking; pre-loading; alcohol consumption; theory of planned behaviour; self-determination theory; undergraduate alcohol consumption

Pre-drinking is a pattern of alcohol consumption that has received increased attention in research on the harmful effects of alcohol. Pre-drinking (also referred to as, *pre-loading*, *pre-partying*, *pre-gaming*) is defined as the consumption of alcohol, usually at one's home or another's residence, prior to attending another social event which usually involves further alcohol consumption (e.g., attending bars, clubs; Pedersen & LaBrie, 2007). Research by DeJong et al. (2010) showed students reported consuming, on average, 4.9 drinks during their most recent pre-drinking occasion. This average exceeds safe drinking guidelines that recommend consuming fewer than four standard drinks on drinking occasions to avoid the risks of alcohol-related harm (National Health and Medical Research Council, 2009). Recent research indicates that university student pre-drinkers report higher total alcohol intake on drinking occasions that involve pre-drinking, and are more likely to be involved in alcohol-related accidents and violence, than on occasions that do not involve pre-drinking (Hummer, Napper, Ehret, & LaBrie, 2013). A recent Australian study has demonstrated that three quarters of drinkers between the ages of 18 and 25 report pre-drinking within the past year (MacLean & Callinan, 2013). Given the majority of Australian university students fall within this age bracket and are known to report higher incidence of risky drinking practices when compared to their non-student peers (Hallett et al., 2012; Kypri, Cronin, & Wright, 2005), pre-drinking is likely a prevalent practice among Australian university students.

Recent studies have looked to the psychological, social, and economic factors related to the increasing prevalence of pre-drinking as a pattern of alcohol consumption. A major reason for pre-drinking appears to be the lower cost of consuming pre-purchased alcohol, when compared with purchasing and consuming alcohol at licensed venues (Caudwell & Hagger, 2014; MacLean & Callinan, 2013; Miller & Droste, 2013). Pre-drinking is also considered to have emerged in response to increased legislative or premise-based policies intended to reduce excessive drinking at licensed venues effectively displacing excessive

drinkers to private residences (Wells, Graham, & Purcell, 2009; Wiggers, Tindall, Gillham, & Lecathelinais, 2012). The social elements of pre-drinking have also been linked to its prevalence. University students report pre-drinking as an opportunity to socialize, relax, and become sufficiently intoxicated prior to attending the main event (Wells et al., 2009). Interpersonal enhancement (drinking for enjoyment or entertainment) also appears a strong motive underlying student pre-drinkers (Caudwell & Hagger, 2014; LaBrie, Hummer, Pedersen, Lac, & Chithambo, 2012).

There have been relatively few applications of psychological theory to understand pre-drinking behaviour (see Foster & Ferguson, 2013). Theory-based research is important because it provides a hypothesis-testing framework for understanding the mechanisms and processes underlying health behaviours, and paves the way for guiding the development of effective interventions that target the theoretical constructs that have been found to predict health-related behaviour, such as reducing alcohol consumption. The theory of planned behaviour (Ajzen, 1991) is a theoretical framework that has been widely used in the health behaviour field (Ajzen, 2014; McEachan, Conner, Taylor, & Lawton, 2011). The theory posits that behavioural *intention* is the proximal predictor of subsequent behaviour, and that intention is predicted by three variables; *attitude*, *subjective norm*, and *perceived behavioural control* (Ajzen, 1991). Attitude reflects an individual's beliefs that performing a given 'target' behaviour will lead to salient outcomes; subjective norm reflects the extent to which an individual believes that important social referents want them to engage in the target behaviour; and perceived behavioural control reflects the extent of an individual's capacity to engage in the target behaviour. Intention mediates the effect of these constructs on behaviour, with perceived behavioural control also exerting a direct effect when it approximates actual behavioural control (Ajzen, 1991).

The theory of planned behaviour has demonstrated predictive efficacy across many health behaviours and contexts (Armitage & Conner, 2001; Hagger, Chatzisarantis, et al., 2007; McEachan et al., 2011). A recent meta-analysis of studies adopting the theory in the context of alcohol consumption found support for the relationships posited by the theory, between attitudes and intentions, and intention and behaviour (Cooke, Dahdah, Norman, & French, 2014). However, these relationships differed depending on the type of alcohol consumption behaviour under investigation, with authors noting a paucity of investigating certain patterns of alcohol consumption, such as pre-drinking (Cooke et al., 2014). Further, augmentations of the theory of planned behavior that may increase the variance explained for certain behaviours should be considered (Conner, 2014; McEachan et al., 2011). Therefore, alternative theoretical approaches that may increase predictive efficacy of existing health behavioural models, that offer insight into the elements underlying behavioural intention and engagement and may hold utility in designing health behavioural interventions, should be considered (Conner, 2014; Hagger, 2009; Hagger & Chatzisarantis, 2009b).

Another theory that has been applied extensively to understand and predict health behaviour is self-determination theory (Deci & Ryan, 1985). The key premise of self-determination theory is that the *quality* of an individual's motivation is an important factor determining behavioural engagement and persistence. Motivation is posited to exist on a continuum reflecting the perceived origins of behavioural engagement. The continuum ranges from *controlled motivation* to *autonomous orientation* and is known as the *perceived locus of causality* (Ryan & Connell, 1989). *External regulation* denotes motivation from external sources, such as to gain reward or to avoid punishment, or from others. *Introjected regulation* refers to individuals being motivated to pursue certain behaviours to avoid feelings such as guilt or shame. Both external regulation and introjected regulation are considered types of controlled motivation. *Identified regulation* relates to goals, or favored outcomes (e.g., pre-

drinking to save money, or because it makes for an enjoyable occasion). *Intrinsic motivation* reflects engaging in behaviour for reasons consistent with an individual's personal goals and needs, in the absence of any external contingency, and done for the inherent enjoyment and satisfaction the behaviour offers. Identified regulation and intrinsic motivation are considered autonomous forms of motivation. An additional element to self-determination theory is that motives are proposed to arise from the satisfaction of basic psychological needs that are considered innate and universal (Sheldon, Elliot, Kim, & Kasser, 2001). Specifically, individuals are more likely to experience autonomous forms of motivation toward behaviour when three psychological needs (*autonomy*, *competence*, and *relatedness*) are met (Ryan & Deci, 2000). Conversely, when an individual feels these needs are not supported, or thwarted, they experience less self-determined forms of motivation. Research has demonstrated that the fulfilment of these psychological needs are linked to greater reported autonomous motivation and higher levels of engagement in various health-promoting behaviours (Ng et al., 2012; Ryan & Deci, 2000). Meta-analyses of research adopting self-determination theory have found it a sound conceptual framework for assessing the influence of motivation on a range of health-related behaviours (Chatzisarantis, Hagger, Biddle, Smith, & Wang, 2003; Ng et al., 2012).

A recent approach has been to integrate self-determination theory and the theory of planned behaviour to improve model predictive efficacy and give further insight into the motivational elements underlying health behaviour (Hagger & Chatzisarantis, 2009b). Integrating compatible theories can address individual shortcomings in each theory and give a more comprehensive account of the factors associated with health behaviours which may influence further research, policy, and potential for theory-based interventions (Hagger, 2009). Integration of self-determination theory and the theory of planned behaviour is based on the notion that an individual's autonomous and controlled motivational orientation from

self-determination theory influences the formation of intention, through the mediation of attitudes, subjective norm, and perceived behavioural control, from the theory of planned behaviour (Hagger & Chatzisarantis, 2009). It is important to note the differing ontological and epistemological perspectives of these two theories and whether they could potentially offer complementary explanations of behaviour. Self-determination theory comes from an organismic perspective, based on the fulfilment of psychological needs; as such, motivational orientations reflect *generalised* tendencies to act in a behavioural domain in order to fulfil these needs. In contrast, social cognitive theories such as the theory of planned behaviour are based on beliefs regarding *future* engagement in an activity. A possible means by which these theories could complement each other lies in explanations of origins and how distal motives are translated into actions. Self-determination theory provides some indication of the origins of the social cognitive beliefs, based on the idea that an individual will seek out further opportunities to engage in behaviours that are need-satisfying, and form congruent beliefs regarding these behaviours. The theory of planned behaviour assists in delineating the process by which the generalised motives from self-determination theory are converted into actual behaviour. For example, an individual who feels autonomously motivated to pre-drink may form congruent beliefs regarding the evaluation of future engagement in pre-drinking; these beliefs may in turn influence their intentions to pre-drink.

Research has adopted the integration of the two theories to predict behaviour (Hagger & Chatzisarantis, 2009b, 2012). In the context of alcohol consumption, the integrated model has been adopted to heavy episodic drinking in a sample of company employees across three time points (Hagger, Lonsdale, Hein, et al., 2012). Results indicated that, identified regulation, an autonomous form of motivation, and attitudes to reduce excessive drinking, accounted for a substantial proportion of the variance in heavy episodic drinking behaviour, suggesting that participants may choose to reduce their alcohol consumption because they

value the benefits of avoiding adverse alcohol-related health effects and believe it beneficial to keep their drinking within safe limits.

The present study

Given the evidence supporting the integration of self-determination theory and the theory of planned behaviour into a single model (Hagger & Chatzisarantis, 2009b; Hagger, Lonsdale, Hein, et al., 2012), it may provide a theoretical framework to guide research into the motives underpinning pre-drinking behaviour. Research on self-determination theory has tended to focus on links between autonomous motivation and avoidance of risky, health-compromising behaviours (e.g., alcohol consumption, eating a high-fat diet), and between autonomous motivation and uptake of adaptive health behaviours (Ng et al., 2012). Much of the research investigating the link between self-determination theory and alcohol consumption have found controlled forms of motivation tend to be associated with increased alcohol consumption, and conversely, autonomous forms of motivation are associated with avoidance of, or reduced alcohol consumption (Neighbors, Lewis, Fossos, Grossbard, & Brown, 2007). Generally, research suggests that controlled motivation leads individuals to consume alcohol due to social pressures, typical of exhibiting extrinsic rationales for behavioural engagement (Chawla, Neighbors, Logan, Lewis, & Fossos, 2009; Neighbors, Larimer, Markman G., & Knee, 2004). However, Amiot, Sansfaçon, and Louis (2013) comment on the lack of self-determination theory research on the relationship between autonomous motivation and engaging in harmful behaviours (e.g., drug use, cheating). They found that when considering harmful behaviours, university students favoring in-group norms reported higher self-determined motivation to engage in behaviour consistent with the norms. This indicates that individuals may be similarly autonomously motivated to pursue health-risk behaviours (e.g., pre-drinking), in part due to normative influences. Therefore, the influence of subjective norm in the theory of planned behaviour may be congruent with

controlled or autonomous reasons for acting. In addition to these studies, the meta-analysis by McEachan et al. (2011) included studies adopting the theory of planned behaviour on intention to avoid alcohol consumption as well as to consume alcohol, which show comparable predictive efficacy in terms of the theoretical components. Considering these findings, we adopted a novel approach in the present study to apply the integrated model to predict intentions to pre-drink and pre-drinking frequency in undergraduate students.

We proposed a series of hypotheses that reflected the stimulated pattern of effects of the integrated model, based upon the proposed motivational sequence in which relations between motivational orientations from self-determination theory and intentions with respect to pre-drinking are mediated by constructs from the theory of planned behaviour (see Figure 1 for a diagrammatic representation of the proposed relationships between theoretical constructs). Specifically, we hypothesized that autonomous motivation toward pre-drinking would positively predict attitude, subjective norm, and perceived behavioural control (H_1). This hypothesis was based on previous research finding attitudes and perceived behavioural control are more likely consistent with autonomous motivation (e.g., Hagger, Chatzisarantis, & Biddle, 2002; Hagger, Chatzisarantis, & Harris, 2006b; Hagger, Lonsdale, Hein, et al., 2012) and that individuals may also be autonomously motivated to engage in behaviour because drinking at the behest of others is consistent with their autonomous motives and their genuine sense of self (Amiot et al., 2013). However, we also expected that controlled motivation would predict subjective norm (H_2) as this variable may reflect perceived social approval to engage in behaviour, consistent with externally-referenced reasons for acting and previous research regarding controlled orientations and alcohol consumption (Chawla et al., 2009; Knee & Neighbors, 2002). Consistent with the latter proposal, we expected no effects for controlled motivation on attitudes and perceived behavioural control (H_3) as these are more likely to be aligned with autonomous motivation and have been consistently related to

beliefs that reflect this motive (i.e., attitudes and perceived behavioural control). In keeping with the main tenets of the theory of planned behaviour (Ajzen, 1991), we expected attitude, subjective norm, and perceived behavioural control to significantly predict intention (H₄). We also hypothesized that intention and perceived behavioural control (H₅) would predict pre-drinking frequency directly, where the latter approximated actual control (i.e., where perceptions of control reflect actual behavioural control unrelated to one's intentions). With regards to the motivational sequence specified by the integrated model, and results of previous research (Amiot et al., 2013; Hagger, Lonsdale, Hein, et al., 2012), we expected the effects of autonomous motivation on intention be mediated by attitude, subjective norm, and perceived behavioural control (H₆). Similarly, we expected the effect of controlled motivation on intention to be mediated by subjective norm only (H₇) and that there would be no mediation of this path by attitude or perceived behaviour control (H₈). Further, we anticipated the direct effects of autonomous and controlled motivation on intention would be zero, as the effects would be fully mediated by the proximal antecedent constructs from the theory of planned behaviour (H₉). Finally, we hypothesized three-segment paths from autonomous motivation to pre-drinking behaviour through attitude, subjective norm, perceived behavioural control, respectively, and intention (H₁₀). We also proposed that autonomous motivation would predict pre-drinking behaviour indirectly through perceived behavioural control (H₁₁). Similarly, we hypothesized a three-segment path from controlled motivation to pre-drinking behaviour through subjective norm and intention (H₁₂), but not through attitude nor perceived behavioural control and intention, or through perceived behavioural control (H₁₃).

Method

Design

A prospective correlational design was adopted. Study measures were included in two separate internet-based questionnaires administered at two time points, four-weeks apart. Self-report measures of psychological variables from self-determination theory and the theory of planned behaviour as well as a self-report measure of past alcohol consumption were collected at baseline, with behavioural data (i.e., pre-drinking sessions) collected at a follow-up time point, four weeks later. Data were collected over a period of four months¹.

Participants

Ethical approval was secured by the [University omitted for masked review] university human research ethics committee prior to data collection. Undergraduate students were recruited via social media and recruitment posters placed on noticeboards and prominent locations around university campus locations in Western Australia. Participation was incentivized through entry into a prize draw or by offering course credit. Participants were eligible if they were aged 18 years or older and enrolled in a full-time course at a Western Australian university. A total of 508 participants completed the baseline questionnaire with 341 (67.1%) completing the follow-up questionnaire.²

Measures

Past Alcohol Consumption Behaviour. Participants' alcohol consumption was collected using a computer-assisted personal interviewing method (Del Boca & Darkes, 2003). Participants were asked to enter the amount of alcohol they had consumed in each

¹We conducted a univariate ANOVA to test whether self-reported pre-drinking frequency (recorded at follow-up) differed significantly between months of data collection. The result was statistically non-significant; $F(3,278) = .529, p = .663$; partial $\eta^2 = .006$, indicating a lack of sampling bias.

²A MANOVA indicated there was no significant difference between completers and non-completers in terms of their item scores on theoretical and behavioural measures at baseline; $F(36, 456) = .894, p = .648$; Wilk's $\Lambda = 0.934$, partial $\eta^2 = .066$. Tests of attrition bias revealed no statistically-significant difference in age ($t(498) = -3.73, p = .709$) or gender distribution ($\chi^2(1) = .046, p = .830$) across completers and non-completers who provided useable responses.

week in standard drink equivalents over the previous four weeks. In order to mitigate social desirability effects, we included statements reaffirming confidentiality as a preface to survey questions, and provided participants with a pictorial reference to assist in estimating their alcohol consumption, adapted from the National Health and Medical Research Council's (2009) standard drinks guide.

Definition of Pre-Drinking and Participant Identification as a Pre-Drinker.

Participants were presented with the following statement defining pre-drinking behaviour, based on a conceptual definition provided by Pedersen and LaBrie (2007): "...drinking alcohol (purchased at a liquor store or supermarket) at your home or someone else's house before you 'go out' for the night (e.g., visiting a bar, pub, nightclub, music venue, gig, or other social gathering)" (p. 238). This definition has been frequently used in other pre-drinking research (e.g., Zamboanga, Schwartz, Ham, Borsari, & Van Tyne, 2010).

Participants who indicated having engaged in pre-drinking in the past six months continued with the questionnaire and were invited to complete the follow-up upon completion, while those who had not were directed to an exit page.

Autonomous and Controlled Forms of Motivation. Measures of autonomous and controlled forms of motivation from self-determination theory were based on Ryan and Connell's (1989) perceived locus of causality scale and adapted from Hagger et al. (2011) to refer to pre-drinking behaviour. Participants were asked "*Why are you likely to drink alcohol at your home or someone else's before 'going out'?*" and were directed to respond to a series of reasons reflecting underlying motivational constructs: *introjected regulation* (e.g., "I feel ashamed when I do not drink before I go out"); *extrinsic regulation* (e.g., "I drink alcohol because other people say I should"); *identified regulation* (e.g., "It is important for me to drink alcohol before I go out"), and; *intrinsic motivation* (e.g., "I enjoy drinking before I go out"). Four items were used for each construct; with Likert-type response scales ranging from

1 (*not true at all*) to 4 (*very true*). We used responses to introjected regulation and extrinsic regulation items to create a scale for *controlled motivation*, and responses on identified regulation and intrinsic motivation to create a scale for *autonomous motivation*.

Theory of Planned Behaviour. Items measuring the attitude, subjective norm, perceived behavioural control, and intention constructs from the theory of planned behaviour were developed in line with Ajzen's (2002) recommendations. Items made reference to the target behaviour (i.e., pre-drinking), the time frame of interest (i.e., over the past/next four weeks), and the behavioural context (i.e., on each individual occasion or session). Attitude was measured on five items preceded by a common stem: "For me, [pre-drinking] over the next four weeks is..." followed by five-point bipolar adjective scales: *unimportant/important*, *not worthwhile-worthy*, *harmful-beneficial*, *unenjoyable-enjoyable*, and *bad-good*. Subjective norm was measured using three items (e.g., "People who are important to me would approve of my decision to [pre-drink] over the next four weeks") with responses made on 6-point scales ranging from *strongly disagree* (1) and *strongly agree* (6). Perceived behavioural control was measured using three items (e.g., "How much personal control do you have over [pre-drinking] over the next four weeks?") with responses made on six-point scales ranging from *no control at all* (1), to *complete control* (6). Intention was measured using three items (e.g., "I intend to pre-drink over the next four weeks") with responses made on 6-point scales anchored by *extremely unlikely* (1) and *extremely likely* (6).

Follow-up Pre-drinking Behaviour. In a follow-up questionnaire, participants entered the number of times they had engaged in pre-drinking each week, for the previous four weeks, into four text boxes, using the same CAPI method as in baseline and similar to previous research (e.g., Hagger, Lonsdale, Hein, et al., 2012; LaBrie et al., 2012).

Procedure

Participants were directed to a web page providing information on the study and a link to the online baseline questionnaire. Participants were informed that consent to participate was considered declared once they indicated that they had agreed with the ethics statements and consented to complete the questionnaire. Participants were required to enter their email address at baseline, which was retained on the server for automated distribution of the invitation to complete the second questionnaire, four weeks later. Participants were either offered prize draw entry or points toward course credit for their participation. Data were matched across time points using an anonymized code unique to each participant.

Data Analyses

Variance-based structural equation modeling (VB-SEM) was used to test the adequacy of the hypothesized model in accounting for variance in the endogenous variables while controlling for measurement error and to test for significance of the hypothesized pattern of effects. The analysis was conducted using a non-parametric bootstrap resampling technique with 100 samples to maximize stability of path coefficients (Kock, 2012). All variables in the model were latent variables indicated by their corresponding item(s), including past behaviour, pre-drinking frequency, and demographic variables (age, gender). We controlled for past behaviour, gender, and age in analyses by specifying paths from these variables to each of the other variables in the hypothesized model (e.g., Keatley, Clarke, & Hagger, 2013b). Table 1 contains descriptive and model evaluation statistics, and zero-order correlations between modelled variables.

Evaluation of the model was made at the measurement and structural levels according to published criteria for VB-SEM models (Vinzi, Chin, Henseler, & Wang, 2010). In summary, the model is considered suitable if: composite reliability (α) and internal consistency of measures (ρ) exceed .70; when average variance explained (AVE) in each

latent variable exceeds .50, and; the AVE for each variable exceeds the value of the correlation between that variable and all others in the model (Vinzi et al., 2010). Full colinearity variance inflation factor (FCVIF) values lower than 3.30 indicate no model issues with multicollinearity (Kock, 2012). Model fit is evaluated by the Q^2 coefficient exceeding zero for endogenous variables, significant average R^2 (ARS) and average path coefficient (APC) values (Kock, 2012), and the goodness-of-fit statistic (.10, .25, and .36 correspond to small, medium, and large effect sizes; Tenenhaus, Amato, & Vinzi, 2004). Hypothesized mediation effects were tested by calculating indirect effects from a bootstrapped resampling method with 100 replications (Kock, 2012). Mediation was confirmed by the presence of a statistically-significant indirect effect, with the direct effect being either statistically significant (partial mediation) or non-significant (full mediation).

Results

Participants

A total of 286 (83.9%) of the follow-up sample reported pre-drinking within the previous four weeks, and were included in the final analysis ($M_{age} = 21.45$ years $SD = 4.35$ years; 94 male, 190 female). The majority (79.2%) identified as being of Caucasian Australian ethnicity. Descriptive statistics and zero-order latent factor correlations for the study variables are given in Table 1.

Structural Equation Model

Model evaluation statistics for the measurement and structural levels are included in Table 1. The majority of conditions for model evaluation were satisfied, except for a single indicator of the perceived behavioural control factor, which drastically reduced scale reliability and was removed, and subjective norm factor which was marginally below the .70

criteria for reliability ($\rho = .69$). All Q^2 coefficients exceeded zero, indicating sufficient predictive validity in endogenous variables (Kock, 2012). The model predicted 54% ($R^2_{Adj} = .53$) of the variance in student intentions to pre-drink over the next four weeks at baseline, and 20% ($R^2_{Adj} = .18$) of the variance in pre-drinking frequency at follow-up. Fit statistics used to assess VB-SEM models were satisfactory ($ARS = .285$; $ARS_{Adj} = .273$; $APC = .168$; $p < .001$; $GoF = .458$).

Direct effects pertaining to the motivational sequence of the integrated model are depicted in Figure 2. Autonomous motivation was statistically significantly and positively related to attitude and subjective norm, but did not statistically significantly predict perceived behavioural control ($p = .098$), providing partial support for our hypothesis (H_1). Contrary to our hypotheses (H_2 and H_3), controlled motivation did not have a statistically significant effect on subjective norm ($p = .118$), but was statistically significantly and negatively related to attitude and perceived behavioural control. Consistent with the theory of planned behaviour relationships, pre-drinking intention was statistically-significantly predicted by attitude and subjective norm, and negatively predicted by perceived behavioural control, supporting our hypothesis (H_4). Intention statistically significantly and positively predicted pre-drinking frequency; perceived behavioural control statistically-significantly and negatively predicted pre-drinking behaviour, supporting our hypothesis (H_5), indicating that participants' perceived behavioural control approximated their actual control over pre-drinking.

Mediation analyses were conducted by isolating each proposed mediating path and observing the direct, indirect, and total effects and observing whether the mediation was complete (only indirect effect is statistically significant) or partial (both direct and indirect effects are statistically significant) (Kock, 2011). Table 2 lists the hypothesized direct, indirect, and total effects. Broadly consistent with H_6 , we found statistically significant direct

and indirect effects of autonomous motivation on intention, indicating that this relationship was partially mediated by attitude and subjective norm, but not by, perceived behavioural control³. We found no support for the mediating effects of controlled motivation on intentions mediated by subjective norms, leading us to reject our hypothesis (H₇). There were also no indirect effects of controlled motivation on intention mediated by attitudes and perceived behavioural control in support of our hypothesis (H₈).

Autonomous motivation had a statistically-significant direct effect on intention (i.e., the effect was not completely mediated), yet we found no direct effects for controlled motivation on intention, indicating only partial support for our hypothesis (H₉). We found no support for three-segment paths from autonomous motivation to pre-drinking behaviour, mediated by attitude, subjective norm, perceived behavioural control, and intention, leading us to reject our hypothesis (H₁₀). The effect of autonomous motivation on pre-drinking behaviour through perceived behavioural control only was also non-significant, leading us to reject out hypothesis (H₁₁). We found no support for mediation of the path from controlled motivation to pre-drinking behaviour through subjective norm and intention, leading us to reject out hypothesis (H₁₂). The effects were not observed through attitude and perceived behavioural control and intention, supporting our hypothesis (H₁₃). Only the indirect pathway from controlled motivation to behaviour through perceived behavioural control was statistically significant; indicating complete mediation and leading us to reject our hypothesis (H₁₄).

Discussion

³We also assessed the relative contribution of each of the variables from self-determination theory and the theory of planned behaviour in predicting pre-drinking intention. Of the significant predictors, autonomous motivation, attitudes, and subjective norm explained 12%, 30%, and 7% of the variance in pre-drinking intention, respectively, providing support for motivational sequence of the model.

The purpose of the present study was to test the effectiveness of an integrated model based on self-determination theory and the theory of planned behaviour in predicting pre-drinking intentions and actual pre-drinking behaviour. Findings supported hypotheses of the proposed model, with notable exceptions that have important ramifications for determining the adequacy of the model and its underlying theoretical bases in the context of pre-drinking. Overall, results indicated that individuals form pre-drinking attitudes and subjective norms that are consistent with autonomous reasons for acting (e.g., valuing benefits, enjoyment), and that these influence intentions to pre-drink. These results are consistent with research by Sheeran et al. (1999), who found attitudinally-controlled intentions tended to be reflective of self-determined motives than normatively-controlled intentions. The effect of autonomous motivation on subjective norm also provides support for Amiot et al. (2013), who found that individuals can be autonomously motivated to comply with social influences in engaging in harmful behaviours. That perceived behavioural control was not predicted by autonomous motivation suggests individuals' perceptions of control are not consistent with autonomous reasons for pre-drinking (i.e., participants may value the benefits of pre-drinking, yet this is unrelated to their perceptions of control).

Our results indicate that exhibiting controlled motivation to engage in pre-drinking behaviour is related to appraising the behaviour in a negative light and beliefs in a lack of control over pre-drinking. An individual who regulates behaviour through external contingencies (e.g., "I will feel embarrassed if I do not pre-drink"), may form negative attitudes towards pre-drinking behaviour (e.g., "harmful", "bad") and may feel less control over pre-drinking (e.g., "it is up to me whether or not I pre-drink") over the behaviour. However, the effects of controlled motivation on attitude were small (i.e., $\beta = -.08$), compared to those of autonomous motivation on attitude. This is consistent with research showing autonomous motivation tends to be a stronger predictor of intention compared to

controlled motivation (Brickell, Chatzisarantis, & Pretty, 2006; Chatzisarantis, Hagger, & Smith, 2007; Hagger, Lonsdale, Hein, et al., 2011; Sheeran et al., 1999) That controlled motivation exerts a stronger effect on perceived behavioural control suggests pre-drinking may influence control beliefs that have a more substantial direct effect on behaviour, than through intention.

The null effect of controlled motivation on subjective norm and subsequent rejection of this hypothesis is inconsistent with descriptions of subjective norms as representing perceived social approval of engaging in behaviour, characteristic of controlled forms of motivation (Hagger, Lonsdale, Hein, et al., 2012). However, it may be that subjective norms are interpreted as more consistent with autonomous reasons for pre-drinking, rather than controlled. Finally, perceived behavioural control was negatively predicted by controlled motivation. This may mean that engaging in pre-drinking for controlled reasons (e.g., to conform, or avoid guilt) is influential in determining lower personal perceptions of control than determining perceived social approval.

With regards to the mediation effects, the relationship between autonomous motivation and intention was partially mediated through attitude and subjective norm, suggesting that these beliefs are somewhat aligned with overall autonomous motives to engage in pre-drinking, such as fulfilling personally-relevant goals and the perceived social approval of others, supporting our hypotheses regarding these effects. Partial mediation indicates that there may be two processes by which distal motives from self-determination theory affect behaviour: a mediated route that includes intentions and its proximal predictors and a more direct route, that may spontaneously influence intention independent of the formation of belief-based evaluations of pre-drinking (Hagger, Chatzisarantis, & Harris, 2006a). The statistically-significant partial mediation of subjective norm on the autonomous motivation-intention is consistent with Amiot et al.'s (2013) findings and suggests that beliefs

regarding social influences may be more internalized, and, therefore, less likely interpreted as controlling in our sample. This indicates that subjective norm may not constitute self-esteem-based rationales for behavioural engagement.

Consistent with the theory of planned behaviour, we found statistically-significant effects of attitude, subjective norm, and perceived behavioural control on pre-drinking intention. Although intention was a statistically-significant predictor of pre-drinking frequency in our model, the effect was small and was indicative of a substantial intention-behaviour gap (i.e., only 34% of the variance in behaviour was explained), suggesting the model is not adequate in explaining pre-drinking behaviour. Although this contrasts with the findings of Cooke et al. (2014), their meta-analysis revealed that theory of planned behaviour relationships were moderated by the type of alcohol consumption behaviour, which may be evident in pre-drinking behaviour. Alternatively, Ajzen (2011) states that behaviours that have a considerable intention-behaviour gap may be considered non-reasoned in nature, and current results seem to support the notion that our sample may engage in pre-drinking without forming an explicit intention to do so. This is supported by the fact that some of the social cognitive variables from the model predict behaviour directly independent of intentions, which is a clear sign of less deliberative and more spontaneous effects on behaviour (Hagger, 2013; Hagger & Chatzisarantis, 2014; Keatley, Clarke, & Hagger, 2011, 2013a) stronger direct effect of perceived behavioural control on pre-drinking frequency, and lack of support for an indirect effect of perceived behavioural control through intention. It may be that participants who reported higher perceived behavioural control may have not engaged in pre-drinking over the four weeks from baseline, and, participants with low control over pre-drinking may have engaged in pre-drinking more frequently over the period between baseline and follow-up. Results indicate that students tend to spontaneously or impulsively engage in pre-drinking when barriers to doing so are removed, as there was no mediation of intention

on the effect of perceived behavioural control on pre-drinking frequency (e.g., Hagger, Anderson, Kyriakaki, & Darkings, 2007). Given the reported financial hardship experienced by Australian university students (Richard, Bexley, Devline, & Marginson, 2007) and research indicating the price of alcohol is an important factor determining university students alcohol consumption behaviour (Caudwell & Hagger, 2014; Miller & Droste, 2013), it is likely that the cost of drinking or financial situation of students may be a good example of these barriers. Generally speaking, the significant direct effect of past behaviour on pre-drinking frequency suggests substantial variance is unaccounted for by the model variables.

To speculate on the basis of the current data, dual-systems models of behaviour may provide a worthwhile avenue for future research with regards to the prediction of pre-drinking. Dual systems models posit that behaviour is influenced by reflective and impulsive systems (Perugini, Richetin, & Zogmaister, 2010; Strack & Deutsch, 2004). Reflective systems are thought to involve conscious deliberation leading to action (Strack & Deutsch, 2004); explicit processes which we aim to measure using constructs such as those from the theory of planned behaviour. Conversely, impulsive systems are characterized by perceptual, cue-based influences on behaviour (Strack & Deutsch, 2004). Researchers using measures of implicit motivational constructs, such as the implicit association test and go/no-go association task, have demonstrated their effectiveness in predicting a range of alcohol consumption outcomes (Caudwell & Hagger, 2014; Keatley et al., 2013b; Lindgren et al., 2012; Thush & Wiers, 2007; Wiers et al., 2007). Given the weak intention-behaviour relationship observed in the present study and considerable effect of past behaviour, it is worth ascertaining the influence of constructs from the impulsive system in predicting pre-drinking. Alternatively, the prototype-willingness model (Gibbons & Gerrard, 1995) incorporates the construct of behavioural *willingness* (i.e., “how likely are you to engage in behaviour X”) alongside the construct of intention. Recent meta-analyses of the effects of prototypes and willingness on

intentions and behaviour in health-related contexts supports the utility of both willingness and intention in predicting behaviour, particularly so in the context of alcohol consumption behaviour (Todd, Kothe, Mullan, & Monds, 2014; van Lettow, de Vries, Burdorf, & van Empelen, 2014). A recent “modified” dual-processing approach to the prototype willingness model (Gerrard, Gibbons, Houlihan, Stock, & Pomery, 2008) suggests some behaviours such as binge drinking may be “neither entirely planful nor entirely impulsive” (Gibbons, Kingsbury, Gerrard, & Wills, 2011, p. 159), yet still performed with volition (Gerrard et al., 2008). These model developments may therefore provide an alternative framework for future research.

The finding that individuals appear autonomously motivated to form intentions to pre-drink is a matter of concern, considering what is known about the relationships between need satisfaction, autonomous motivation, and health-promoting behaviours (e.g., Ng et al., 2012) and that pre-drinking alcohol consumption is associated with alcohol-related harm (Labhart, Graham, Wells, & Kuntsche, 2013; Merrill, Vermont, Bachrach, & Read, 2013). This represents a potential conflict in motives and outcomes in that pre-drinking appears to be consistent with autonomous motives and psychological need satisfaction, and therefore likely to be adhered to; whereas some of the outcomes associated with pre-drinking are harmful, and therefore inconsistent with other self-relevant motives such as maintaining good health. Autonomously-motivated pre-drinkers may not be aware of the health risks associated with pre-drinking (e.g., Labhart et al., 2013; Reed et al., 2011) or they may not perceive them to apply to themselves (see Pavey & Sparks, 2010). Future self-determination theory research should, therefore, focus on behaviours in which individuals may be *less* likely to pursue positive health goals, such as reducing excessive drinking, because they are in fact autonomously motivated to pursue these health-risk behaviours (e.g., Amiot et al., 2013).

Strengths, Limitations, and Avenues for Future Research

The present study has a number of strengths including: (1) a focus on an under-researched behaviour, pre-drinking, which represents a substantive and documented risk to the health of students; (2) the adoption and application of an integrated theoretical model and variance-based structural equation analyses that permitted comprehensive test of the processes by which motivational and belief-based variables impacted on pre-drinking intentions and behaviour; (3) the adoption of a prospective design that allowed the prediction of future pre-drinking behaviour; and (4) the recruitment of a sample of undergraduate students of sufficient size to test hypothesized effects.

Some limitations in the present study must be noted. Even though a prospective design was adopted, the current data are correlational and, as with all studies adopting such designs, this places limits on the inference of causality in effects tested in the proposed model (Hagger & Chatzisarantis, 2009a). In addition, the current sample was not randomly recruited or stratified and this places limits on the generalizability of the findings. However, the distribution and prevalence of pre-drinking activity and overall alcohol consumption of participants in the present study appear broadly consistent with other research (Hummer et al., 2013; LaBrie et al., 2012; Zamboanga et al., 2010) providing some evidence that the current sample's pre-drinking behaviour was characteristic of the target population.

An innovation of the current study is its focus on motivation to engage in pre-drinking behaviour, with findings inconsistent with previous research linking autonomous motivation to the avoidance of risky alcohol consumption (see Neighbors et al., 2007). Given the established links between autonomous motivation and health-promoting behaviours, the finding that autonomous motivation is related to the formation of positive attitudes and intentions to pre-drink presents an issue for self-determination theory research that largely focuses on behaviours and outcomes that are adaptive and conducive to optimal functioning (Amiot et al., 2013; Ng et al., 2012). Future applications of the integrated model in the area of

pre-drinking should seek to resolve this theoretical paradox. This may be by simultaneously examining autonomous and controlled forms of motivation from self-determination theory toward participation in, and avoidance of, pre-drinking. This could potentially assist in helping to resolve the apparent conflict between the motivational factors that underpin approach and avoidance of pre-drinking behaviour.

Theory-based interventions may focus on changing beliefs toward pre-drinking, perhaps by introducing the risk associated with excessive alcohol consumption and pre-drinking or educating students about estimating and employing safe levels of drinking (see De Visser & Birch, 2012; Pavey & Sparks, 2010). The key to interventions based on current findings may lie in making health information more salient and promoting autonomous reasons for pursuing healthy choices with respect to alcohol, which may shift attitudes toward reducing excessive drinking in pre-drinkers. However, given the intention-behaviour discrepancy or ‘gap’ in the present study, there may be little merit in solely attempting to change precursors of behavioural intention if this will not engender behaviour change (Hagger, Lonsdale, & Chatzisarantis, 2011, 2012; Hagger, Lonsdale, Koka, et al., 2012; Hagger & Luszczynska, 2013; Webb & Sheeran, 2006). Research that investigates some of the aspects related to individuals’ perceptions of control over pre-drinking (i.e., behavioural barriers) that are unrelated to their intentions may therefore present an important avenue for future research. Furthermore, dual-systems models of behaviour that take into account the measurement of reflective and impulsive determinants of behaviour may allow insights into the factors precipitating pre-drinking (e.g., Caudwell & Hagger, 2014; Keatley et al., 2011; Keatley et al., 2013b). Inclusion of such measures and may seek to increase the variance accounted for in outcome measures of alcohol consumption, and provide important avenues for theory-based interventions (e.g., Houben, Havermans, Nederkoorn, & Jansen, 2012; Houben, Nederkoorn, Wiers, & Jansen, 2011).

In conclusion, the present study identifies some influential motivational and social-cognitive pathways to pre-drinking behaviour that appear somewhat inconsistent with previous research on other alcohol consumption behaviours. Individuals have autonomous motives and strong attitudes toward pre-drinking; and subjective norms seem to be closely aligned with autonomous motives rather than more controlling forms of motivation. Given the prediction of behaviour directly by perceived behavioural control and past behaviour, researchers should consider looking to theories that incorporate impulsive processes that may influence alcohol consumption behaviour beyond intentional or deliberative processes (Hofmann, Friese, & Wiers, 2011). This study provides a novel contribution to the increasing research focused on pre-drinking as a potentially dangerous pattern of alcohol consumption behaviour common in undergraduate populations.

References

- Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, 50(2), 179-211. doi: 10.1016/0749-5978(91)90020-t
- Ajzen, I. (2002). Constructing a TPB questionnaire: Conceptual and methodological considerations. 1-14.
- Ajzen, I. (2014). The theory of planned behaviour is alive and well, and not ready to retire: A commentary on Sniehotta, Pesseau, and Araújo-Soares. *Health Psychology Review* (Advance online publication), 1-7. doi: 10.1080/17437199.2014.883474
- Amiot, C. E., Sansfaçon, S., & Louis, W. R. (2013). Investigating the motivations underlying harmful social behaviors and the motivational nature of social norms. *Journal of Applied Social Psychology*, 43(10), 2146-2157. doi: 10.1111/jasp.12167
- Armitage, C. J., & Conner, M. (2001). Efficacy of the theory of planned behaviour: A meta-analytic review. *The British Journal of Social Psychology*, 40, 471-499.
- Brickell, T. A., Chatzisarantis, N. L. D., & Pretty, G. M. (2006). Autonomy and control augmenting the validity of the Theory of Planned Behaviour in predicting exercise. *Journal of Health Psychology*, 11(1), 51-63.
- Caudwell, K. M., & Hagger, M. S. (2014). Pre-drinking and alcohol-related harm in undergraduates: the influence of explicit motives and implicit alcohol identity. *Journal of Behavioral Medicine*, 1-11. doi: 10.1007/s10865-014-9573-6
- Chatzisarantis, N. L. D., Hagger, M. S., Biddle, S. J. H., Smith, B., & Wang, J. C. K. (2003). A meta-analysis of perceived locus of causality in exercise, sport, and physical education contexts. *Journal of Sport and Exercise Psychology*, 25(3), 284-306.
- Chatzisarantis, N. L. D., Hagger, M. S., & Smith, B. (2007). Influences of perceived autonomy support on physical activity within the theory of planned behavior. *European Journal of Social Psychology*, 37(5), 934-954.

- Chawla, N., Neighbors, C., Logan, D., Lewis, M. A., & Fossos, N. (2009). Perceived approval of friends and parents as mediators of the relationship between self-determination and drinking. *Journal of Studies on Alcohol and Drugs*, 70(1), 92.
- Conner, Mark. (2014). Extending not retiring the theory of planned behaviour: a commentary on Sniehotta, Pesseau and Araújo-Soares. *Health Psychology Review*, 1-5. doi: 10.1080/17437199.2014.899060
- Cooke, Richard, Dahdah, Mary, Norman, Paul, & French, David P. (2014). How well does the theory of planned behaviour predict alcohol consumption? A systematic review and meta-analysis. *Health psychology review*(ahead-of-print), 1-20.
- De Visser, R. O., & Birch, J. D. (2012). My cup runneth over: Young people's lack of knowledge of low-risk drinking guidelines. *Drug and Alcohol Review*, 31(2), 206-212. doi: 10.1111/j.1465-3362.2011.00371.x
- DeJong, W., DeRicco, B., & Schneider, S. K. (2010). Pregaming: An exploratory study of strategic drinking by college students in Pennsylvania. *Journal of American College Health*, 58(4), 307-316. doi: 10.1080/07448480903380300
- Del Boca, F. K., & Darkes, J. (2003). The validity of self-reports of alcohol consumption: State of the science and challenges for research. *Addiction*, 98, 1-12. doi: 10.1046/j.1359-6357.2003.00586.x
- Foster, J. H., & Ferguson, C. (2013). Alcohol 'pre-loading': A review of the literature. *Alcohol and alcoholism*, agt135.
- Gerrard, Meg, Gibbons, Frederick X., Houlihan, Amy E., Stock, Michelle L., & Pomery, Elizabeth A. (2008). A dual-process approach to health risk decision making: The prototype willingness model. *Developmental Review*, 28(1), 29-61. doi: <http://dx.doi.org/10.1016/j.dr.2007.10.001>

- Gibbons, Frederick X., & Gerrard, Meg. (1995). Predicting young adults' health risk behavior. *Journal of Personality & Social Psychology*, 69(3), 505-517. doi: 10.1037/0022-3514.69.3.505
- Gibbons, Frederick X., Kingsbury, John H., Gerrard, Meg, & Wills, Thomas A. (2011). Two ways of thinking about dual processing: a response to Hofmann, Friese and Wiers (2008). *Health Psychology Review*, 5(2), 158-161. doi: 10.1080/17437199.2010.541823
- Hagger, M. S. (2009). Theoretical integration in health psychology: Unifying ideas and complementary explanations. *British Journal of Health Psychology*, 14(2), 189-194. doi: 10.1348/135910708x397034
- Hagger, M. S. (2013). The opportunity cost model: Automaticity, individual differences, and self-control resources. *Behavioral and Brain Sciences*, 36(06), 687-688.
- Hagger, M. S., Anderson, M., Kyriakaki, M., & Darkings, S. (2007). Aspects of identity and their influence on intentional behavior: Comparing effects for three health behaviors. *Personality and Individual Differences*, 42(2), 355-367. doi: 10.1016/j.paid.2006.07.017
- Hagger, M. S., & Chatzisarantis, N. L. D. (2009a). Assumptions in research in sport and exercise psychology. *Psychology of Sport and Exercise*, 10(5), 511-519.
- Hagger, M. S., & Chatzisarantis, N. L. D. (2009b). Integrating the theory of planned behaviour and self-determination theory in health behaviour: A meta-analysis. *British Journal of Health Psychology*, 14(2), 275-302. doi: 10.1348/135910708x373959
- Hagger, M. S., & Chatzisarantis, N. L. D. (2012). Transferring motivation from educational to extramural contexts: a review of the trans-contextual model. *European journal of psychology of education*, 27(2), 195-212.

- Hagger, M. S., & Chatzisarantis, N. L. D. (2014). An integrated behavior change model for physical activity. *Exercise and Sport Sciences Reviews*, 42(2), 62-69.
- Hagger, M. S., Chatzisarantis, N. L. D., Barkoukis, Vassilis, Wang, John CK, Hein, Vello, Pihu, Maret, . . . Karsai, Istvan. (2007). Cross-cultural generalizability of the theory of planned behavior among young people in a physical activity context. *Journal of Sport and Exercise Psychology*, 29(1), 1-20.
- Hagger, M. S., Chatzisarantis, N. L. D., & Biddle, S. J. H. (2002). The influence of autonomous and controlling motives on physical activity intentions within the Theory of Planned Behaviour. *British Journal of Health Psychology*, 7(3), 283-297.
- Hagger, M. S., Chatzisarantis, N. L. D., & Harris, J. (2006a). From psychological need satisfaction to intentional behavior: Testing a motivational sequence in two behavioral contexts. *Personality and Social Psychology Bulletin*, 32(2), 131-148. doi: 10.1177/0146167205279905
- Hagger, M. S., Chatzisarantis, N. L. D., & Harris, J. (2006b). The process by which relative autonomous motivation affects intentional behavior: comparing effects across dieting and exercise behaviors. *Motivation and Emotion*, 30(4), 306-320. doi: 10.1007/s11031-006-9046-5
- Hagger, M. S., Lonsdale, A., & Chatzisarantis, N. L. D. (2011). Effectiveness of a brief intervention using mental simulations in reducing alcohol consumption in corporate employees. *Psychology, Health & Medicine*, 16(4), 375-392. doi: 10.1080/13548506.2011.554568
- Hagger, M. S., Lonsdale, A., & Chatzisarantis, N. L. D. (2012). A theory-based intervention to reduce alcohol drinking in excess of guideline limits among undergraduate students. *British Journal of Health Psychology*, 17(1), 18-43. doi: 10.1111/j.2044-8287.2010.02011.x

- Hagger, M. S., Lonsdale, A. J., Hein, V., Koka, A., Lintunen, T., Pasi, H., . . . Chatzisarantis, N. L. D. (2011). Predicting alcohol consumption and binge drinking in company employees: An application of planned behaviour and self-determination theories. *British Journal of Health Psychology*, 1-29. doi: 10.1111/j.2044-8287.2011.02043.x
- Hagger, M. S., Lonsdale, A. J., Hein, V., Koka, A., Lintunen, T., Pasi, H., . . . Chatzisarantis, N. L. D. (2012). Predicting alcohol consumption and binge drinking in company employees: An application of planned behaviour and self-determination theories. *British Journal of Health Psychology*, 17(2), 379-407. doi: 10.1111/j.2044-8287.2011.02043.x
- Hagger, M. S., Lonsdale, A., Koka, Andre, Hein, Vello, Pasi, Heidi, Lintunen, Taru, & Chatzisarantis, N. L. D. (2012). An intervention to reduce alcohol consumption in undergraduate students using implementation intentions and mental simulations: A cross-national study. *International Journal of Behavioral Medicine*, 19(1), 82-96.
- Hagger, M. S., & Luszczynska, A. (2013). Implementation intention and action planning interventions in health contexts: State of the research and proposals for the way forward. *Applied Psychology: Health and Well-Being*. doi: 10.1111/aphw.12017
- Hallett, J., Howat, P., Maycock, B., McManus, A., Kypri, Kypros, & Dhaliwal, S. (2012). Undergraduate student drinking and related harms at an Australian university: web-based survey of a large random sample. *BMC Public Health*, 12(1), 37. doi: 10.1186/1471-2458-12-37
- Hofmann, Wilhelm, Friese, Malte, & Wiers, Reinout W. (2011). Impulsive processes in the self-regulation of health behaviour: Theoretical and methodological considerations in response to commentaries. *Health Psychology Review*, 5(2), 162-171. doi: 10.1080/17437199.2011.565593

- Houben, K., Havermans, R. C., Nederkoorn, C., & Jansen, A. (2012). Beer à no-go: learning to stop responding to alcohol cues reduces alcohol intake via reduced affective associations rather than increased response inhibition. *Addiction, 107*(7), 1280-1287. doi: 10.1111/j.1360-0443.2012.03827.x
- Houben, K., Nederkoorn, C., Wiers, R. W., & Jansen, A. (2011). Resisting temptation: Decreasing alcohol-related affect and drinking behavior by training response inhibition. *Drug and Alcohol Dependence, 116*(1-3), 132-136. doi: 10.1016/j.drugalcdep.2010.12.011
- Hummer, J. F., Napper, L. E., Ehret, P. E., & LaBrie, J. W. (2013). Event-specific risk and ecological factors associated with prepartying among heavier drinking college students. *Addictive Behaviors, 38*(3), 1620-1628. doi: 10.1016/j.addbeh.2012.09.014
- Keatley, D. A., Clarke, D. D., & Hagger, M. S. (2011). Investigating the predictive validity of implicit and explicit measures of motivation on condom use, physical activity and healthy eating. *Psychology & Health, 27*(5), 550-569. doi: 10.1080/08870446.2011.605451
- Keatley, D. A., Clarke, D. D., & Hagger, M. S. (2013a). Investigating the predictive validity of implicit and explicit measures of motivation in problem-solving behavioural tasks. *British Journal of Social Psychology, 52*(3), 510-524.
- Keatley, D. A., Clarke, D. D., & Hagger, M. S. (2013b). The predictive validity of implicit measures of self-determined motivation across health-related behaviours. *British Journal of Health Psychology, 18*(1), 2-17. doi: 10.1111/j.2044-8287.2011.02063.x
- Knee, C. Raymond, & Neighbors, Clayton. (2002). Self-determination, perception of peer pressure, and drinking among college students. *Journal of Applied Social Psychology, 32*(3), 522-543. doi: 10.1111/j.1559-1816.2002.tb00228.x

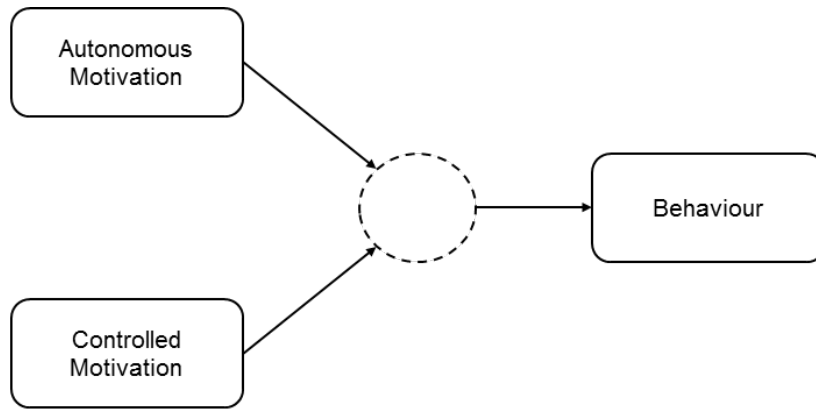
- Kock, N. (2011). Using WarpPLS in e-collaboration studies: Mediating effects, control and second order variables, and algorithm choices. *International Journal of e-Collaboration (IJeC)*, 7(3), 1-13. doi: 10.4018/jec.2011070101
- Kock, N. (2012). *WarpPLS 3.0 User Manual* (pp. 55). Retrieved from http://www.scriptwarp.com/warppls/UserManual_WarpPLS_V3.pdf
- Kypri, Kypros, Cronin, Matthew, & Wright, Craig S. (2005). Do university students drink more hazardously than their non-student peers? *Addiction*, 100(5), 713-714. doi: 10.1111/j.1360-0443.2005.01116.x
- Labhart, F., Graham, K., Wells, S., & Kuntsche, E. (2013). Drinking before going to licensed premises: An event-level analysis of predrinking, alcohol consumption, and adverse outcomes. *Alcoholism: Clinical and Experimental Research*, 37(2), 284-291. doi: 10.1111/j.1530-0277.2012.01872.x
- LaBrie, J. W., Hummer, J. F., Pedersen, E. R., Lac, A., & Chithambo, T. (2012). Measuring college students' motives behind prepartying drinking: Development and validation of the prepartying motivations inventory. *Addictive Behaviors*, 37(8), 962-969. doi: 10.1016/j.addbeh.2012.04.003
- Lindgren, K. P., Neighbors, C., Teachman, B. A., Wiers, R. W., Westgate, E., & Greenwald, A. G. (2012). I drink therefore I am: Validating alcohol-related implicit association tests. doi: 10.1016/j.addbeh.2013.01.026
- MacLean, Sarah, & Callinan, Sarah. (2013). "Fourteen Dollars for One Beer!" Pre-drinking is associated with high-risk drinking among Victorian young adults. *Australian and New Zealand Journal of Public Health*, 37(6), 579-585. doi: 10.1111/1753-6405.12138
- McEachan, R. R. C., Conner, M., Taylor, N. J., & Lawton, R. J. (2011). Prospective prediction of health-related behaviours with the Theory of Planned Behaviour: a

- meta-analysis. *Health Psychology Review*, 5(2), 97-144. doi: 10.1080/17437199.2010.521684
- Merrill, J. E., Vermont, L. N., Bachrach, R. L., & Read, J. P. (2013). Is the pregame to blame? Event-level associations between pregaming and alcohol-related consequences. *J Stud Alcohol Drugs*, 74(5), 757-764.
- Miller, P. G., & Droste, N. (2013). Alcohol price considerations on alcohol and illicit drug use in university students. *Journal of Alcoholism and Drug Dependence*, 1(109), 2. doi: 10.4172/jaldd.1000109
- National Health and Medical Research Council. (2009). *Australian guidelines to reduce risks from drinking alcohol*. Canberra, ACT: Commonwealth of Australia Retrieved from http://www.nhmrc.gov.au/_files_nhmrc/publications/attachments/ds10-alcohol.pdf.
- Neighbors, C., Larimer, M. E., Markman G., I., & Knee, C. R. (2004). Feeling controlled and drinking motives among college students: Contingent self-esteem as a mediator. *Self and Identity*, 3(3), 207-224. doi: 10.1080/13576500444000029
- Neighbors, C., Lewis, M. A., Fossos, N., Grossbard, J. R., & Brown, L. (2007). Motivation and risk behaviors: A self-determination perspective. *Psychology of motivation*, 99-113.
- Ng, Johan Y. Y., Ntoumanis, M., Thøgersen-Ntoumani, C., Deci, Edward L., Ryan, Richard M., Duda, Joan L., & Williams, Geoffrey C. (2012). Self-determination theory applied to health contexts. *Perspectives on Psychological Science*, 7(4), 325-340. doi: 10.1177/1745691612447309
- Pavey, J. L., & Sparks, P. (2010). Autonomy and reactions to health-risk information. *Psychology & Health*, 25(7), 855-872. doi: 10.1080/08870440902929528

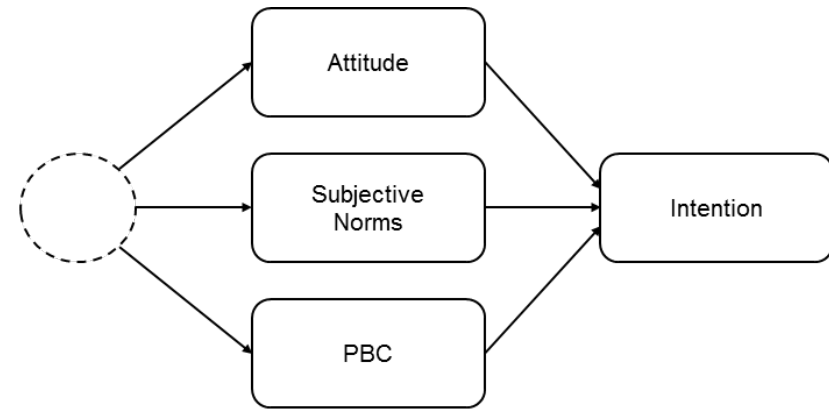
- Pedersen, E. R., & LaBrie, J. (2007). Partying before the party: Examining prepartying behavior among college students. *Journal of American College Health*, 56(3), 237-245. doi: 10.3200/JACH.56.3.237-246
- Perugini, M., Richetin, J., & Zogmaister, C. (2010). Prediction of behavior *Handbook of implicit social cognition: Measurement, theory, and applications* (Vol. 10, pp. 255-278).
- Reed, M. B., Clapp, J. D., Weber, M., Trim, R., Lange, J., & Shillington, A. M. (2011). Predictors of partying prior to bar attendance and subsequent BrAC. *Addictive Behaviors*, 36(12), 1341-1343. doi: 10.1016/j.addbeh.2011.07.029
- Richard, J., Bexley, E., Devline, M., & Marginson, S. (2007). Australian university student finances 2006: Final report of a national survey of students in public universities (U. o. M. Centre for the Study of Higher Education, Trans.) (pp. 97). Canberra, ACT: Universities Australia.
- Ryan, R. M., & Connell, J. P. (1989). Perceived locus of causality and internalization: Examining reasons for acting in two domains. *Journal of Personality & Social Psychology*, 57(5), 749-761. doi: 10.1037/0022-3514.57.5.749
- Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist*, 55(1), 68-78. doi: 10.1037/0003-066x.55.1.68
- Sheeran, P., Norman, P., & Orbell, S. (1999). Evidence that intentions based on attitudes better predict behaviour than intentions based on subjective norms. *European Journal of Social Psychology*, 29(2-3), 403-406. doi: 10.1002/(SICI)1099-0992(199903/05)29:2/3<403::AID-EJSP942>3.0.CO;2-A

- Sheldon, Kennon M, Elliot, Andrew J, Kim, Youngmee, & Kasser, Tim. (2001). What is satisfying about satisfying events? Testing 10 candidate psychological needs. *Journal of Personality and Social Psychology*, 80(2), 325.
- Strack, F., & Deutsch, R. (2004). Reflective and impulsive determinants of social behavior. *Personality and Social Psychology Review*, 8(3), 220-247. doi: 10.1207/s15327957pspr0803_1
- Tenenhaus, M., Amato, S., & Vinzi, V. E. (2004). *A global goodness-of-fit index for PLS structural equation modelling*. Paper presented at the XLII SIS Scientific Meeting, 2004, Padova, Italy. .
- Thush, C., & Wiers, R. W. (2007). Explicit and implicit alcohol-related cognitions and the prediction of future drinking in adolescents. *Addictive Behaviors*, 32(7), 1367-1383. doi: 10.1016/j.addbeh.2006.09.011
- Todd, Jemma, Kothe, Emily, Mullan, Barbara, & Monds, Lauren. (2014). Reasoned versus reactive prediction of behaviour: a meta-analysis of the prototype willingness model. *Health Psychology Review*, 1-24. doi: 10.1080/17437199.2014.922895
- van Lettow, Britt, de Vries, Hein, Burdorf, Alex, & van Empelen, Pepijn. (2014). Quantifying the strength of the associations of prototype perceptions with behaviour, behavioural willingness and intentions: a meta-analysis. *Health Psychology Review*, (Advance online publication), 1-19. doi: 10.1080/17437199.2014.941997
- Vinzi, V. E., Chin, W. W., Henseler, J., & Wang, H. (2010). *Handbook of Partial Least Squares : Concepts, Methods and Applications*. New York, USA: Springer.
- Webb, Thomas L, & Sheeran, Paschal. (2006). Does changing behavioral intentions engender behavior change? A meta-analysis of the experimental evidence. *Psychological bulletin*, 132(2), 249.

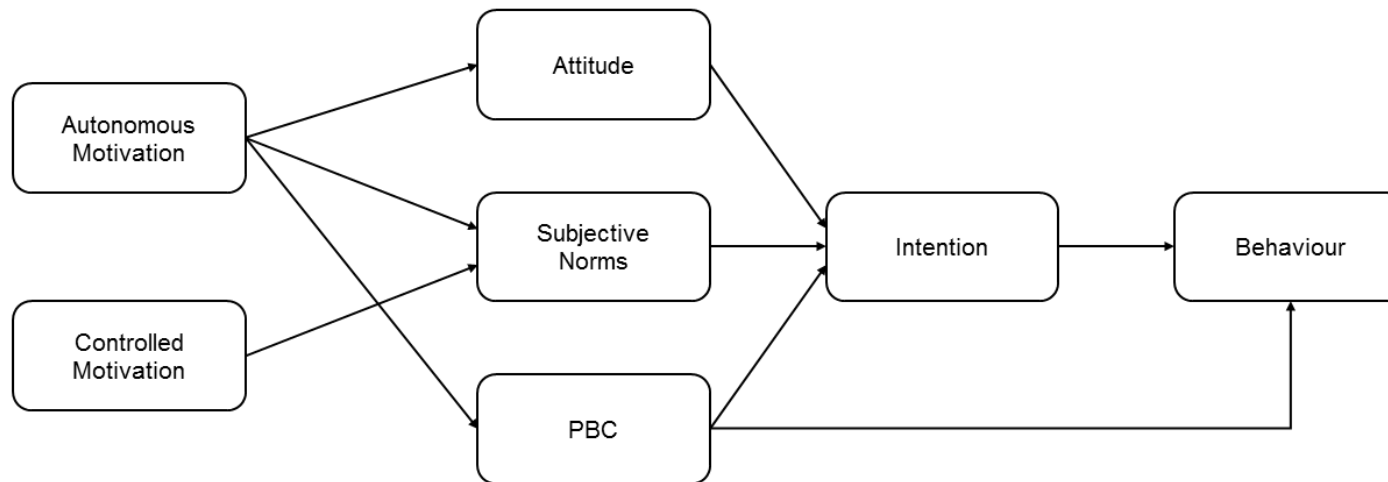
- Wells, S., Graham, K., & Purcell, J. (2009). Policy implications of the widespread practice of 'pre-drinking' or 'pre-gaming' before going to public drinking establishments - Are current prevention strategies backfiring? *Addiction*, 104(1), 4-9. doi: 10.1111/j.1360-0443.2008.02393.x
- Wiers, R. W., Bartholow, B. D., van den Wildenberg, E., Thush, C., Engels, R. C. M. E., Sher, K. J., . . . Stacy, A. W. (2007). Automatic and controlled processes and the development of addictive behaviors in adolescents: a review and a model. *Pharmacology Biochemistry and Behavior*, 86(2), 263-283. doi: 10.1016/j.pbb.2006.09.021
- Wiggers, J., Tindall, J., Gillham, K., & Lecathelinais, C. (2012). Targeted regulation of licensed premises in a city entertainment precinct: Impact on assaults, street offences, and emergency department presentations. *Injury Prevention*, 18(Suppl 1), A46-A47. doi: 10.1136/injuryprev-2012-040580d.29
- Zamboanga, B., Schwartz, S., Ham, L., Borsari, B., & Van Tyne, K. (2010). Alcohol expectancies, pregaming, drinking games, and hazardous alcohol use in a multiethnic sample of college students. *Cognitive Therapy and Research*, 34(2), 124. doi: 10.1007/s10608-009-9234-1



a) SDT proposes that motivational orientations influence behavior, but not how these influences manifest.



b) The TPB proposes that belief-based variables influence intention, but not specifically how these beliefs are formed



c) Integrating the theories forms a motivational sequence whereby the distal motivational orientations from SDT influence intention, through the belief-based variables from the TPB. Consistent with the TPB, intention and PBC influence behaviour.

Figure 1. Diagrammatic representation of the complementarity between self-determination theory (SDT) and the theory of planned behaviour (TPB) and how they are integrated (adapted from Hagger & Chatzisarantis, 2009).

Note. PBC = perceived behavioural control.

Table 1.

Reliability, Validity, and Colinearity Statistics for Latent Variables, and Zero-Order Correlation Matrix^a for Latent Variables in the Integrated Model

	1. Past behavior	2. Age	3. Gender	4. Autonomous Motivation	5. Controlled Motivation	6. Attitude	7. Subjective Norm	8. PBC	9. Intention	10. Pre-drinking
<i>M</i>	6.70	21.45	-	2.54	1.37	4.27	4.32	5.05	4.15	.50
<i>SD</i>	7.75	4.36	-	0.64	0.46	1.06	0.82	0.85	1.5	0.73
<i>R</i> ²	-	-	-	.241	.026	.517	.211	.264	.536	.196
ρ	.871	-	-	.906	.899	.894	.829	.922	.978	.864
α	.802	-	-	.880	.870	.851	.690	.830	.966	.790
<i>FCVIF</i> ^b	1.582	1.217	1.088	2.400	1.381	2.683	1.473	1.451	2.236	1.290
<i>q</i> ²	-	-	-	.245	.027	.516	.212	.269	.535	.190
1	(.793)									
2	.135*	(1)								
3	-.215**	.002	(1)							
4	.445**	-.134*	-.030	(.741)						
5	.096	-.111	-.057	.301**	(.730)					
6	.388**	-.208**	-.076	.695**	.145*	(.792)				
7	.258**	-.215**	-.015	.404**	.191**	.472**	(.787)			
8	-.210**	.192**	-.019	-.301**	-.440**	-.224**	-.044	(.924)		
9	.356**	-.242**	.006	.614**	.175**	.694**	.466**	-.258**	(.968)	
10	.364**	-.034	-.032	.352**	.217**	.322**	.127*	-.293**	.279**	(.784)

Note. * $p < .05$, ** $p < .01$.

PBC = Perceived Behavioral Control; ρ = composite reliability; α = Cronbach's alpha; FCVIF, Full Colinearity Variance Inflation Factor. The squared average variance extracted (AVE) statistic for each latent variable is presented on the principal diagonal of the correlation matrix.

Table 2

Mediation Analyses Showing the Direct, Indirect, and Total Effects for the Hypothesized Model Paths

Path	Direct (f^2)	p	Mediator	Indirect (f^2)	p	Total (f^2)	p	Mediation
AM-Int	.188 (.116)	<.001	Att	.281 (.173)	<.001	.470 (.288)	<.001	Partial
			SN	.041 (.025)	.009	.229 (.141)	<.001	Partial
			PBC	.005 (.003)	.198	.194 (.119)	<.001	None
CM-Int	.015 (.003)	.353	Att	-.043 (.007)	.022	-.028 (.005)	.225	None
			SN	.011 (.002)	.138	.026 (.004)	.261	None
			PBC	.030 (.005)	.058	.045 (.008)	.109	None
PBC-PD	-.156 (.046)	.014	Int	-.010 (.003)	.127	-.166 (.049)	.008	None
AM-PD	.162 (.057)	.006	Att-Int	.016 (.006)	.281	.179 (.063)	<.001	None
			SN-Int	.002 (.001)	.310	.164 (.058)	.004	None
			PBC-Int	<.001 (<.001)	.342	.196 (.069)	.002	None
			PBC	.016 (.006)	.123	.178 (.063)	.004	None
			Int	.010 (.003)	.275	.172 (.060)	.001	None
CM-PD	.102 (.022)	.064	Att-Int	-.005 (.001)	.121	.097 (.021)	.076	None
			SN-Int	.001 (<.001)	.235	.103 (.022)	.060	None
			PBC-Int	.004 (.001)	.124	.168 (.037)	.012	None
			PBC	.060 (.013)	.024	.162 (.035)	.015	Complete
			Int	.006 (.001)	.186	.108 (.023)	.052	None

Note. AM= autonomous motivation; Int = intention; CM = controlled motivation; PBC = perceived behavioural control; PD = pre-drinking frequency; Att = Attitude; SN = Subjective Norm.

Indirect effects calculated via bootstrap resampling method. Effects are shown controlling for past behaviour, age, and gender.

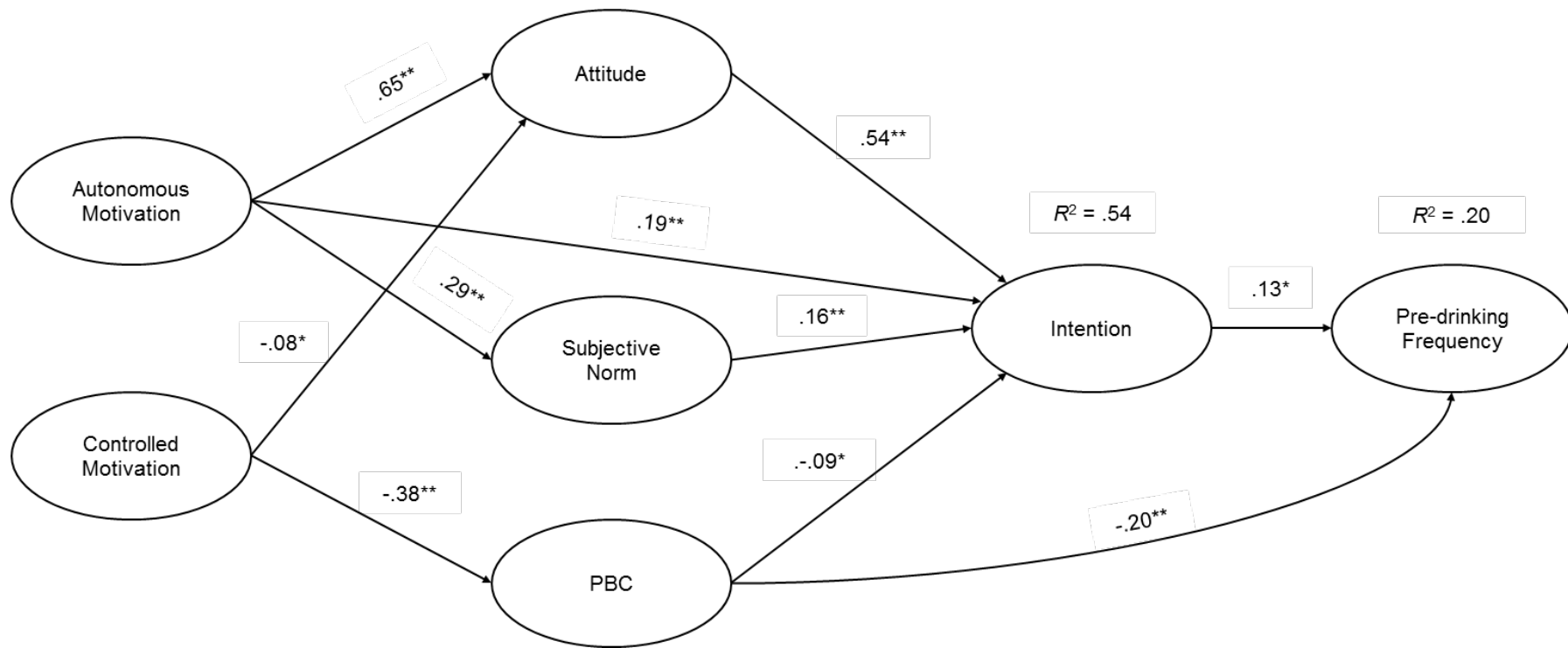


Figure 2. Results of the VB-SEM analyses showing statistically significant direct and indirect path coefficients between variables in the integrated theoretical model.

Note. * $p < .05$; ** $p < .01$.

Paths estimated from control variables to model variables are as follows: Past behavior \rightarrow Autonomous Motivation ($\beta = 0.49$; $p < .001$); Past behavior \rightarrow Controlled Motivation ($\beta = 0.11$; $p = .019$); Past behavior \rightarrow Attitude ($\beta = 0.21$; $p < .001$); Past behavior \rightarrow Subjective Norm ($\beta = 0.16$; $p = .012$); Past behavior \rightarrow PBC ($\beta = -0.17$; $p = .001$); Past behavior \rightarrow Intention ($\beta = 0.12$; $p = .01$); Past behavior \rightarrow Pre-drinking frequency ($\beta = 0.28$; $p < .001$); Age \rightarrow Autonomous Motivation ($\beta = -0.20$; $p = .003$); Age \rightarrow Controlled Motivation ($\beta = -0.13$; $p = .007$); Age \rightarrow Attitude ($\beta = -0.15$; $p < .001$); Age \rightarrow Subjective Norm ($\beta = -0.19$; $p < .001$); Age \rightarrow PBC ($\beta = 0.16$; $p < .001$); Age \rightarrow Intention ($\beta = -0.10$; $p = .004$); Age \rightarrow Pre-drinking frequency ($\beta < -0.01$; $p = .474$); Gender \rightarrow Autonomous Motivation ($\beta = 0.08$; $p = .096$); Gender \rightarrow Controlled Motivation ($\beta = -0.04$; $p = .292$); Gender \rightarrow Attitude ($\beta = -0.04$; $p = .211$); Gender \rightarrow Subjective Norm ($\beta = 0.03$; $p = .296$); Gender \rightarrow PBC ($\beta = -0.08$; $p = .082$); Gender \rightarrow Intention ($\beta = 0.07$; $p = .051$); Gender \rightarrow Pre-drinking frequency ($\beta = 0.02$; $p = .35$).

**CHAPTER III: PRE-DRINKING AND ALCOHOL-RELATED HARM IN
UNDERGRADUATES: THE INFLUENCE OF EXPLICIT MOTIVES AND
IMPLICIT ALCOHOL IDENTITY**

This is the accepted version of the following article: Caudwell, K. M., & Hagger, M. S. (2014). Pre-drinking and alcohol-related harm in undergraduates: the influence of explicit motives and implicit alcohol identity. *Journal of Behavioral Medicine*, 37(6), 1252-1262. doi:10.1007/s10865-014-9573-6. The final publication is available at Springer via <http://dx.doi.org/10.1007/s10865-014-9573-6>

Pre-drinking and alcohol-related harm in undergraduates: The influence of explicit motives
and implicit alcohol identity

Kim M. Caudwell & Martin S. Hagger

Health Psychology and Behavioural Medicine Research Group, School of Psychology and
Speech Pathology, Curtin University

Bentley, WA, 6100, Australia

email: kim.caudwell@postgrad.curtin.edu.au

Abstract

The present study investigated how pre-drinking could be explained using a model based on dual-systems theory, incorporating measures of explicit and implicit constructs.

Undergraduate students ($N = 144$; 44 male; 100 female; $M_{\text{age}} = 20.1$ years), completed an online survey comprising measures of pre-drinking motives, a measure of pre-drinking cost motives, and an alcohol identity implicit association test. Variance-based structural equation modelling revealed that the predictors explained 34.8% of the variance in typical pre-drinking alcohol consumption and 25% of the variance in alcohol-related harm. Cost, interpersonal enhancement, and barriers to consumption motives predicted higher typical pre-drinking alcohol consumption and greater alcohol-related harm. Higher situational control scores predicted lower typical pre-drinking alcohol consumption, and lower alcohol-related harm. Positive implicit alcohol identity predicted alcohol-related harm, but not typical alcohol consumption. Results indicate that a dual-systems approach to pre-drinking has utility in predicting alcohol-related harm and may inform interventions to reduce excessive alcohol consumption and associated harm.

Keywords: alcohol, pre-drinking, pre-loading, dual-systems theory, alcohol-related harm

Introduction

Excessive alcohol consumption is particularly prominent in university student populations; students tend to outdrink their non-student peers on drinking occasions (Slutske et al., 2004). A recent web-based study demonstrated that the vast majority of university students drink alcohol, and of those who do drink, a third are doing so at hazardous levels Hallett et al. (2012). *Pre-drinking* (also known as *pre-partying*) refers to the consumption of alcohol at home or a private residence, prior to going to a subsequent event for the evening (such as a party, bar, or night club) where drinking often continues (Pedersen & LaBrie, 2007). Miller (2013) conducted a large-scale, multi-site, random sample of Australians on nights out in popular drinking locations on Friday and Saturday nights, to gather information on their drinking behaviors. Of the national sample (N = 6,762), 65% of interviewees reported pre-drinking during their current night out, with 85% of these doing so in private homes. Although large-scale prevalence data is informative, to date, few studies have investigated the relationship between the psychological factors influencing pre-drinking, and how they may relate to alcohol consumption in pre-drinking sessions, and alcohol-related harm. Research that identifies these factors can lead to a more comprehensive understanding of excessive alcohol consumption during pre-drinking sessions that may be informative for health behavioral interventions.

Pre-drinking can lead to excessive alcohol consumption and has been linked to alcohol-related harm in a number of studies. LaBrie et al. (2011) showed that a quarter of American college students reported drinking to unconsciousness within the past month with much of the alcohol consumed during pre-drinking sessions. Research by Hughes et al. (2008) showed that pre-drinkers in the United Kingdom were more than four times more likely to consume as much as five times the recommended safe drinking limit over an evening, and more than twice as likely to have been involved in a confrontation in the *night-*

time environment (popular bar or night club areas). Miller's (2013) multi-site study sampling drinkers in Australian night-time environments found that pre-drinkers were more likely to report engaging in aggressive behavior, experiencing alcohol-related accidents, and driving under the influence of alcohol, than non-pre-drinkers. These results have been corroborated in university populations, where students were shown to be more likely to consume more alcohol during pre-drinking occasions, and more likely to experience alcohol-related harm than those who did not pre-drink on these occasions (Hummer, Napper, Ehret, & LaBrie, 2013; Labhart, Graham, Wells, & Kuntsche, 2013; Pedersen & LaBrie, 2007).

Pre-drinking motives

LaBrie, Hummer, Pedersen, Lac, and Chithambo (2012) developed and validated the *prepartying motives inventory*, a measure of pre-drinking-specific motives that comprises four motive dimensions. *Interpersonal enhancement* consists of motives regarding the social elements of pre-drinking, including meeting and talking to new people, and enjoying the pre-drinking environment. *Intimate pursuit* reflects pre-drinking for the purpose of seeking a romantic or sexual partner during pre-drinking or at the subsequent event. *Situational control* refers to being able to exert some control over alcohol consumption that is perhaps not possible in other drinking contexts, such as the type or alcoholic beverage consumed, avoiding drink tampering, and not having to drink at the subsequent event following pre-drinking. *Barriers to consumption* reflect pre-drinking motives related to having access to or being in possession of alcohol in contexts where doing so is risky (e.g., alcohol-free or policed events). LaBrie et al. (2012) demonstrated the validity of the inventory in their scale-development study, however there may be other factors that influence pre-drinking not fully accounted for by the measure.

Cost of alcohol appears an important motive for pre-drinking reported by student pre-drinkers, who largely consider pre-drinking as an inexpensive way of becoming intoxicated prior to attending a subsequent event (e.g., Pedersen, LaBrie, & Kilmer, 2009; Read, Merrill, & Bytschkow, 2010). Price has been raised as the most important factor influencing pre-drinking, reported by 61% of pre-drinkers on nights out, followed by social motives such as fun and socialisation, reported by 22.4% of pre-drinkers (Miller, 2013). Miller and Droste (2013) provide further evidence in investigating the effect of increasing the cost of alcohol on university students' hypothetical drinking behavior. They found that at a price between \$1 and \$3 per standard drink, their entire sample reported willingness to consume four or more drinks; as price increased to \$10 per drink, less than a quarter of the sample were still willing to do so. Although pre-drinking was not a focus of Miller and Droste's (2013) study, evidence indicates expensive drinks in licensed premises may favour the consumption of cheap alcohol prior to attending these premises (e.g., Miller, 2013), making pre-drinking an appealing option for alcohol consumption. An item reflecting cost was included during development of LaBrie and colleagues' (2012) prepartying motive inventory; however, the authors indicated it was not sufficiently contained within the factor structure of the inventory and was therefore omitted from the final version. This appears to be an important omission, as financial motives clearly represent an important motive for pre-drinking and may present an avenue for individual-level or policy-based interventions to reduce excessive pre-drinking. For example, frugality has been identified as negatively predicting alcohol expenditure, as well as typical and peak session alcohol consumption in college students (Rose, Smith, & Segrist, 2010). Although pre-drinkers motivated by cost may be considered frugal, findings from Barton and Husk (2012) show that pre-drinkers in fact spend *more* money in total on nights involving pre-drinking than those who did not pre-drink, a fact which may be communicated in health behavior-change interventions. From a policy perspective, pre-

drinkers motivated by cost may be responsive to minimum or ‘floor’ pricing policies that may remove or reduce the financial incentive in pre-purchasing alcohol at cheaper retail prices (Lonsdale, Hardcastle, & Hagger, 2012; MacLean & Callinan, 2013).

Impulsive processes and alcohol consumption

Recently, research has looked at the influence of impulsive processes on alcohol consumption behaviors (e.g., Houben & Wiers, 2006, 2009; Lindgren et al., 2012). Much of this research takes a dual-systems approach to explaining behavior (e.g., Strack & Deutsch, 2004), which posits that behavior is influenced by reflective and impulsive systems operating in parallel and interacting with each other. The reflective system incorporates deliberations or conscious processes that influence behavior (e.g., planning, intention); whereas the impulsive system incorporates automated, associative processes that influence behavior. The impulsive system is thought to constitute an associative store of episodic and semantic links between perceptual input, and behavioral schemata (Strack & Deutsch, 2004). This associative store may include positive affective reactions, or typical approach-avoidance behavioral tendencies, following presentation of certain perceptual stimuli (Hofmann, Friese, & Wiers, 2008). These associations are thought to be quickly reactivated in future presentation of such stimuli, which may override processes in the reflective systems, such as intention, restraint, or self-control (Hofmann et al., 2008). With respect to alcohol consumption, excessive past experience with alcohol consumption may lead to the formation of strong associative clusters in the impulsive system that may supersede more deliberative, reflective processes, and contribute to problematic patterns of alcohol consumption (see Wiers et al., 2007).

Numerous authors have advocated a dual-systems approach to improve the prediction of health behavior by including measures of impulsive processes (e.g., Hagger, 2013a, 2013b; Hagger & Chatzisarantis, 2014; Hofmann, Friese, & Strack, 2009; Sheeran,

Gollwitzer, & Bargh, 2013) such as the implicit association test (IAT; Greenwald, McGhee, & Schwartz, 1998). Such an approach may be particularly important to predict risky health behaviors such as excessive alcohol consumption, where predictive models based on exclusively explicit theories of behavior perform less well than for behaviors requiring planning or intending to act. For example, dieting or physical activity behaviors appear to be better predicted by models based on the *theory of planned behavior* than risk or abstinence-based behaviors, such as engaging in alcohol consumption, or reducing alcohol use (see McEachan, Conner, Taylor, & Lawton, 2011). Keatley, Clarke, and Hagger (2012, 2013) showed that a range of spontaneous behaviors, that ostensibly required less planning, were better predicted by implicit measures of motivation than explicit measures. Similarly, Churchill et al. (2008) found that incorporating implicit measures to a theory of planned behavior model significantly improved prediction of impulsive snacking behavior. Research into the prediction of alcohol consumption behaviors by measures of implicit processes may also have marked importance in the applied sense. For example, Houben et al. (2010; 2012) demonstrated that participants presented with alcohol cues that were consistently paired with negative responses (a type of *evaluative conditioning*) exhibited stronger negative implicit attitudes toward alcohol and a subsequent reduction in alcohol consumption over the following week relative to controls (Houben, Havermans, Nederkoorn, & Jansen, 2012; Houben, Havermans, & Wiers, 2010). Studies such as these show the importance of considering influences on behavior from both reflective and impulsive systems in order to identify the predictors of behavior.

The present study

The aim of the present study was to investigate how pre-drinking alcohol consumption and alcohol-related harm could be explained using a predictive model based on dual-systems theory, incorporating measures of both reflective and impulsive systems.

Although the prepartying motives inventory has demonstrated criterion validity in predicting pre-drinking alcohol consumption, we expect that self-reported cost motive, a factor excluded from that inventory, may be an important determinant of pre-drinking, especially in an Australian sample (Miller, 2013; Miller & Droste, 2013). A further focus of the study was to investigate the relationship between pre-drinking motives and perceived alcohol-related harm, which, as yet, appears unexplored. In addition, evidence for the role of implicit processes in alcohol consumption warrants consideration how implicit measures may predict alcohol consumption behaviors such as pre-drinking, and alcohol-related harm. Therefore, we adopted a dual-systems perspective to investigate the predictive validity of both the prepartying motives inventory and self-reported cost motive as explicit measures, and the alcohol identity implicit association test as an implicit measure, in their prediction of typical pre-drinking alcohol consumption, and alcohol-related harm. We hypothesised that four pre-drinking motives from the prepartying motives inventory, *intimate pursuit* (H₁), *interpersonal enhancement* (H₂), *barriers to consumption* (H₃), and *situational control* (H₄), would significantly and positively predict students' self-reported typical pre-drinking alcohol consumption. We also hypothesised that *self-reported cost* motive would have positively predict pre-drinking alcohol consumption, independent of the effects of other dimensions from the pre-parting motives inventory (H₅), given evidence from previous research indicating that cost is a primary reason for pre-drinking. We also hypothesised that greater implicit alcohol identity would positively predict typical pre-drinking alcohol consumption (H₆), and that these effects would be independent of the explicit motive dimensions captured in the prepartying motives inventory.

In addition, we hypothesised that the four pre-drinking motives, *intimate pursuit* (H₇), *interpersonal enhancement* (H₈), *barriers to consumption* (H₉), and *situational control* (H₁₀), would significantly predict alcohol-related harm in students. We also predicted that self-

reported cost motive would have a pervasive effect on alcohol-related harm (H_{11}) given the association between cost and pre-drinking, and that pre-drinkers encounter more alcohol-related harm on drinking occasions (e.g., Barry, Stellefson, Piazza-Gardner, Chaney, & Dodd, 2013; Labhart et al., 2013). Finally, we hypothesised that implicit alcohol identity would predict alcohol-related harm (H_{12}), and that these effects would be independent of the explicit motive dimensions captured in the prepartying motives inventory.

Method

Participants

One hundred and forty-four undergraduate psychology students (44 male, 100 female, $M_{\text{age}} = 20.1$ years, $SD = 1.58$ years) participated in the study for course credit. Criteria for inclusion in the study were: (1) current university student status; (2) over legal drinking age (18 years); and (3) had engaged in at least one pre-drinking occasion in the previous month. The majority of participants (82%) identified as being of Caucasian Australian ethnicity, and 76.4% of the sample reported drinking alcohol approximately once a month. Participants reported first drinking alcohol at a mean age of 15.9 years ($SD = 1.53$), and first becoming intoxicated at 16.3 years ($SD = 1.57$). The study was approved by the [University omitted for peer review] University Health Research Ethics committee in advance of data collection.

Materials

Pre-drinking motives. The pre-partying motives inventory (PMI; LaBrie et al., 2012) is a 16-item measure comprising common reasons or motives relating to student pre-drinking behavior. Students are asked to rate how often each statement reflects their reasons for pre-drinking in the last 12 months, on a five-point Likert-type scale ranging from 1 (*almost never/never*) to 5 (*almost always/always*). The PMI has four motive dimension subscales.

Interpersonal enhancement (6 items) relates to pre-drinking to enhance sociability and interaction prior to the event (e.g., "...to meet new friends once I go out"). *Intimate pursuit* (three items) relates to pre-drinking to increase the likelihood of meeting potential romantic or sexual partners (e.g., "...to increase the likelihood of hooking up."). *Situational control* (four items) relates to pre-drinking to control the type or quantity of alcohol consumed during a session (e.g., "...to enjoy my favourite drink in case the place I'm going does not serve that drink"). *Barriers to consumption* (two items) reflects pre-drinking to mitigate the lack of alcohol at the later function or to avoid negative repercussions related to taking alcohol to a function (e.g., "...to avoid getting caught with alcohol on the way to, or at, the final destination"). We included an item reflecting self-reported cost motive that was omitted from the scale following its validation ("*I pre-drink because it is cheaper than purchasing drinks at the destination*") as cost has been implicated as an important reason for pre-drinking (MacLean & Callinan, 2013; Miller, 2013; Read et al., 2010). We expected this measure to have a significant independent effect on pre-drinking behavior irrespective of whether or not it was associated with the other items on the inventory or did not load neatly on any one factor from the inventory.

Implicit alcohol identity. We used the alcohol identity implicit association test (AI-IAT; Gray, LaPlante, Bannon, Ambady, & Shaffer, 2011) to measure students' implicit alcohol identity. The AI-IAT has been found to significantly predict unique variance in alcohol consumption, craving, and related problems, after controlling for explicit predictors (Lindgren et al., 2012). The AI-IAT is a computer-administered categorisation task comprising two target (*me* and *not me*) and two attribute (*drinker* and *non-drinker*) categories and a list of words related to each (i.e., *me, mine, me, self, they, them theirs, other, drinker, partier, drunk, drink, non-drinker, abstainer, sober, abstain*). Participants are required to categorise words into their respective target or attribute category as they are presented in

trials, by pressing designated keys on their computer keyboard. We created a five-step online version of the AI-IAT. Participants could correct erroneous responses by pressing the correct key before advancing to the next trial. The IAT was scored according to the improved D-score algorithm suggested by Greenwald et al. (2003). Positive D-scores were indicative of strong implicit alcohol identity.

Alcohol consumption. Participants estimated how much alcohol they would consume during a typical pre-drinking session, in Australian standard drink equivalents, with the aid of a pictorial guide adapted from National Health and Medical Research Council (NHMRC; 2009) guidelines. In order to illustrate the pre-purchased element in pre-drinking sessions, larger containers of alcohol (e.g., 700mL bottles, 24-can cartons) were included in the guide as well as measures used on licensed premises (e.g., a 335ml beer bottle). We also measured participant alcohol consumption frequency using an item from the AUDIT-C (Bush, Kivlahan, McDonell, Fihn, & Bradley, 1998).

Alcohol-related harm. The Brief Young Adult Alcohol Consequences Questionnaire (B-YAACQ) was used as a measure of alcohol-related harm. The B-YAACQ consists of 24 statements regarding negative experiences related to alcohol consumption in the previous three months (e.g., passing out from drinking, having a hangover) with respondents prompted to provide a ‘yes’ or ‘no’ response to each. We scored *no* responses as 0, and *yes* responses as 1, and summed responses to form an index of alcohol-related harm for each participant ranging from 1 to 24, with higher scores indicating higher alcohol-related harm.

Procedure

Participants were provided with information on the study and were invited to access an online questionnaire. Participants consented to participate by clicking ‘Agree’ to a series of statements regarding their informed consent. Participants completed demographic

questions as well as measures of alcohol consumption, the PMI, and the AI-IAT. The measures were presented in a random order to each participant, and items within measures were displayed in a random order, to avoid potential presentation-order effects.

Results

Preliminary analyses

In terms of alcohol consumption frequency, 98 (76.4%) participants indicated they drank alcohol at least once a month. On average, participants reporting drinking 6.6 standard drinks during a typical pre-drinking session ($SD = 4.0$, median = 6). Table 1 includes descriptive statistics of the study variables.

Variance-Based Structural Equation Model

Correlations between study measures are included in Table 1. Controlling for alcohol consumption frequency, we used variance-based structural equation modelling to test the relationships between the explicit PMI motive dimensions and cost motive, and the AI-IAT in how they predicted typical alcohol consumption during pre-drinking sessions, and experience of negative alcohol-related consequences on the B-YAACQ in the previous month. Latent variables were generated for each PMI motive dimension from their respective indicators. The AI-IAT and B-YAACQ scores were modelled as single-indicator latent variables, the former from participant D-scores, and the latter from the summed alcohol-related harm index. We sought to establish whether the self-reported cost motive item would load on the barriers to consumption subscale, as anticipated by LaBrie et al (2012). However, consistent with LaBrie et al., cost failed to load significantly on any PMI subscale. Given previous research on the importance of cost in driving alcohol consumption decisions in students and young

adult Australians (Miller, 2013; Miller & Droste, 2013), we retained the self-reported cost motive as a single-indicator latent variable in our analyses.

Evaluation of the model was made at the measurement and structural levels according to published criteria for VB-SEM models (Vinzi, Chin, Henseler, & Wang, 2010). In summary, the model was considered suitable if the following latent variable criteria were met: (1) composite reliability (ρ) and internal consistency (α) exceeded .70; (2) the average variance extracted (AVE) exceeded .50, and; (3) the square root of the AVE exceeded the value of the correlation between that variable and all others in the model (Vinzi et al., 2010). For the PMI, item loadings should exceed .50 ($p < .05$) on their respective motive dimensions (Hair, Black, Babin, & Anderson, 2009). Full-collinearity variance-inflation factor (FCVIF) values lower than 3.30 indicate no issues with multicollinearity (Kock, 2012). Overall model fit was evaluated by the Q^2 coefficient exceeding zero for endogenous variables (Hair, Sarstedt, Ringle, & Mena, 2012), significant average R^2 (ARS) and average path coefficient (APC) values (Kock, 2012), and the goodness-of-fit (GoF) statistic (.100, .250, and .360 correspond to small, medium, and large effect sizes; Tenenhaus, Amato, & Vinzi, 2004).

Reliability coefficients and average variance extracted (AVE) values for the PMI are provided in Table 1. Overall, the model fit was adequate (APC = .160, ARS = .299, Adj. ARS = .263, Tenenhaus GoF = .516). The PMI motive dimensions, self-reported cost motive, and AI-IAT predicted 25% (Adj. R^2 = .211, Q^2 = .255) of the variance in B-YAACQ scores, and 34.8% (Adj. R^2 = .315, Q^2 = .353) of the variance in typical pre-drinking alcohol consumption. Model path coefficients between the PMI motive dimensions and self-reported cost motive, AI-IAT, and both typical pre-drinking alcohol consumption and B-YAACQ scores are included in Figure 1.

Results indicated that the *intimate pursuit* motive dimension from the PMI did not significantly predict typical pre-drinking alcohol consumption, leading us to reject H₁. The *interpersonal enhancement*, *barriers to consumption*, and *situational control* motive dimensions from the PMI significantly predicted typical pre-drinking alcohol consumption, supporting H₂ through H₄. The self-reported cost motive item also significantly predicted typical pre-drinking alcohol consumption, supporting H₅. The AI-IAT did not significantly predict typical pre-drinking alcohol consumption, leading to rejection of H₆.

With regards to the hypotheses underlying alcohol-related harm, *intimate pursuit* did not significantly predict scores on the B-YAACQ, leading to the rejection of H₇. However, the *interpersonal enhancement*, *barriers to consumption* and *situational control* motive dimensions significantly predicted B-YAACQ scores, supporting H₈₋₁₀. Self-reported cost motive positively predicted B-YAACQ scores, supporting H₁₁. The AI-IAT significantly predicted scores on the B-YAACQ, supporting H₁₂.

Discussion

The aim of the present study was to examine the effects of explicit pre-drinking motives and implicit alcohol identity on typical pre-drinking alcohol consumption and alcohol-related harm. We adopted a dual-systems approach to propose hypothesised effects of explicitly-measured self-reported motives from the pre-drinking motives inventory and an implicit association test of alcohol identity on typical pre-drinking alcohol consumption and alcohol-related harm outcomes. We also included the self-reported cost motive as a single-indicator latent variable as an additional predictor of outcomes our analyses, in response to research that has identified cost as a key reason for pre-drinking and its lack of inclusion in the pre-drinking inventory. We anticipated that the explicit and implicit measures would predict these outcome variables in a pattern consistent with dual-systems models (e.g.,

Perugini, 2005; Strack & Deutsch, 2004). To our knowledge, this is the first study to adopt a dual-systems approach in predicting a specific alcohol consumption behaviour (i.e., pre-drinking) and its consequences.

Explicit motives. Focusing on the effects of motives from the pre-partying inventory that were proposed to reflect more explicit factors influencing typical pre-drinking alcohol consumption, we found that self-reported pre-drinking alcohol consumption was statistically significantly and positively predicted by *interpersonal enhancement* and *barriers to consumption*, and negatively predicted by *situational control*. Pre-drinking alcohol consumption was not, however, significantly predicted by *intimate pursuit*.

As *interpersonal enhancement* motives relate to socialising with friends and making for an interesting drinking occasion, these results are consistent with the body of research highlighting the influence of social dynamics that underpin individuals' pre-drinking behavior (e.g., Pedersen & LaBrie, 2007; Pedersen et al., 2009). That *situational control* negatively predicted typical pre-drinking alcohol consumption contrasts with the results of LaBrie et al (2012), who found a positive relationship between these variables. It is possible that individuals who pre-drink for reasons associated with situational control may do so to enjoy specific drinks, or types of drinks, in the pre-drinking context. In doing so, they may consume less alcohol when pre-drinking as they are focused on enjoying the beverage itself rather than more hedonistic motives such as interpersonal enhancement or intimate pursuit. Individuals who score lower on situational control may therefore consume more alcohol during pre-drinking sessions. This has potential implications for interventions that promote the enjoyment of types of alcoholic beverages in moderation, rather than excessive, uninhibited alcohol consumption. The *barriers to consumption* motive reflects being motivated to pre-drink based on the availability or ability to consume alcohol at the subsequent destination. LaBrie et al. (2012) speculated that individuals who endorse this

motive likely attain peak BAC during pre-drinking sessions, to optimise the intoxication “buzz” that carries them through the evening. Our results appear consistent with this premise indicating that restricted access to alcohol at the destination (e.g., queuing, drink limits) motivates individuals to consume more alcohol during pre-drinking sessions (e.g., Wells et al., 2009). In addition, the significant effect of self-reported cost motive on typical pre-drinking alcohol consumption is consistent with findings throughout the literature that individuals appear motivated to pre-drink because it is a cost-effective way of becoming intoxicated for the subsequent event relative to purchasing alcohol when at the subsequent event (Miller, 2013). These findings suggest that pre-drinking may potentially be effectively controlled by the introduction of ‘floor’ pricing schemes, or introducing a volumetric taxation system, that reduces the motive to pre-drink for cost reasons (Byrnes, Cobiac, Doran, Vos, & Shakeshaft, 2010; Lonsdale et al., 2012).

For the second set of hypotheses, relating to the effects of motives on perceived alcohol harm, *interpersonal enhancement*, *barriers to consumption* and *situational control* significantly predicted alcohol-related harm. *Intimate pursuit* did not significantly predict scores on our measure of alcohol-related harm, suggesting that this motive is not consistent with excessive drinking leading to alcohol-related harm. The finding that *interpersonal enhancement* significantly predicted alcohol-related harm suggests that individuals who pre-drink to socialise while consuming alcohol may encounter higher instances of alcohol-related harm. A potential focus for future research may be upon ‘drinking games’ (Hummer et al., 2013), which allow individuals to socialise while consuming large quantities of alcohol at pre-drinking sessions, potentially contributing to the experience of alcohol-related harm. That higher scores on the *barriers to consumption* dimension significantly predicted alcohol-related harm is consistent with the relationship between this dimension and pre-drinking alcohol consumption. The finding indicates that individuals endorsing this motive may also

be likely to encounter alcohol-related harm as a result of excessive pre-drinking for reasons related to access to alcohol (e.g., LaBrie et al., 2012). *Situational control* scores negatively predicted alcohol-related harm, indicating that pre-drinkers who value exerting control over their alcohol consumption during pre-drinking sessions potentially report lower alcohol-related harm, perhaps due to drinking less during pre-drinking sessions.

Self-reported cost motive significantly predicted alcohol-related harm, which highlights the risk associated with being motivated to pre-drink because cheap alcohol can be consumed prior to going out, and alcohol-related harm. This finding presents a dilemma for initiatives aimed at reducing excessive drinking by increasing the cost of alcohol for consumers. For example, Anderson, Chisholm, and Fuhr (2009) reported that policy-based increases in alcohol prices indeed led to both reduced alcohol consumption and alcohol-related harm in many countries. However, trends show that some consumers tended to seek out cheaper alternatives in response. For instance, the *alcopops tax* introduced in Australia to reduce excessive consumption of ready-to-drink alcoholic beverages appeared to do so, however evidence suggests some consumers instead opted for cheaper, higher alcoholic content beverages such as spirits and cask wine (Doran & Digiusto, 2011; Skov et al., 2011). Legislative interventions based on increasing the cost of alcohol may do well to target cheaper alcoholic beverages specifically, such as ‘floor’ pricing schemes (e.g., Lonsdale et al., 2012), to reduce the financial incentive influencing pre-drinking (MacLean & Callinan, 2013) and contributing to alcohol-related harm.

Implicit Alcohol Identity. Given recent findings in the area of dual-systems research (Lindgren et al., 2012), we hypothesised that pre-drinkers who exhibited stronger positive implicit alcohol identities would likely report consuming more alcohol during pre-drinking sessions. This was not supported by our results ($p = .07$; $f^2 = .03$). This suggests that pre-drinking alcohol consumption may be more influenced by the reflective system than the

impulsive system, with stronger effects for the explicit pre-drinking motives. This finding is supported by Hofmann et al. (2008) who remark that in the research on health behaviours, such as alcohol consumption and snacking, strong reflective influences often mean that the behavioural impact of impulsive influences is likely to be negligible. Considering the significant zero-order correlations between the implicit alcohol identity and pre-drinking alcohol consumption, and between implicit alcohol identity and both interpersonal enhancement and cost motive, we conducted a post-hoc analysis to test for mediation of these explicit motives on the relationship between implicit alcohol identity and typical pre-drinking alcohol consumption. However, we found no support for mediation.

It is possible that the generality of the measures might be a factor determining the strength of the effects. As our measure of implicit alcohol identity, the AI-IAT, is a general measure of implicit alcohol identity, it may be that it is not as effective in predicting typical pre-drinking alcohol consumption as the PMI motives, which refer specifically to pre-drinking. The development of implicit measures with a high-level of contextual specificity is a current challenge for dual-systems research (e.g., Keatley et al., 2012). For example, it would be difficult to develop an implicit measure of pre-drinking identity using the IAT methodology as it would be a challenge to identify stimulus words that were exclusive to pre-drinking and not also relevant to general alcohol identity.

Supporting our hypothesis, implicit alcohol identity significantly and positively predicted alcohol related harm, consistent with research by Lindgren et al. (2012). Results indicate that implicit alcohol identity may predict problems related to alcohol consumption in pre-drinkers better than it predicts alcohol consumption during pre-drinking sessions. This may be in part due to the nature of the behaviors included in the B-YAACQ – that is, spontaneous, unplanned consequences to consuming alcohol (e.g., “*When drinking, I have done impulsive things I regretted later*”) which are often better predicted by implicit

measures (Keatley et al., 2013). This finding supports the premise for *evaluative conditioning* interventions in pre-drinkers that are seeing increasing support in the alcohol literature (Hofmann et al., 2008; Houben et al., 2010). It may be important to incorporate such components as part of a broader dual-systems framework that targets influential routes to specific alcohol consumption behaviours and their consequences (Hofmann et al., 2008).

Strengths, limitations, and future research directions

The present study has several strengths. To our knowledge, this is the first study applying a dual-systems theoretical approach to investigate explicit motives and implicit alcohol identity on pre-drinking behavior, an alcohol consumption behavior with demonstrable risks (e.g., Barry et al., 2013; Labhart et al., 2013). The present findings are especially important given the increasing evidence suggesting that explicit models of behavior appear less effective in predicting a range of harmful behaviors (e.g., excessive alcohol consumption) than pro-health behaviors (McEachan et al., 2011), and that the incorporation of both explicit and implicit factors in predictive models leads to more effective prediction in these models (Churchill et al., 2008). Recent evaluative conditioning studies also highlight potential intervention strategies that target impulsive systemic influences on behavior (e.g., Houben et al., 2012). These may be particularly influential in reducing excessive alcohol consumption in populations where interventions based on more explicit methods of behavior change (e.g., intention, planning) or the efficacy of which is dependent on implicit influences (see Ostafin & Palfai, 2012). To our knowledge, this is the first study to examine the effects of implicit alcohol identity in the context of pre-drinking, and advances knowledge by indicating the relative contribution of implicit and explicit motives on pre-drinking behaviour. Results indicate implicit measures may be used to evaluate the contribution of the relative contribution of the impulsive system for different patterns of alcohol consumption.

The present study also used a recently-validated measure of motives specifically related to pre-drinking, showing the relative influence of endorsing certain motives on alcohol consumption during pre-drinking sessions and alcohol-related harm, supporting the ecological validity of the prepartying motives measure. Future research into pre-drinking should include the prepartying motives inventory as it highlights potential avenues for intervention. For instance, the present results suggest the promotion of situational control-related motives in pre-drinking situations may lead to reductions in alcohol consumption and alcohol-related harm in pre-drinkers. Similarly, considering barriers to curb or reduce consumption in intervention efforts, primarily regarding drinking at the subsequent destination (e.g., bar, night club), would be a worthwhile endeavour. Although we did not observe our cost motive significantly loading on a pre-partying motives inventory dimension, we included it in our analyses and found it was a strong predictor of both typical pre-drinking alcohol consumption and alcohol-related harm in pre-drinkers. The relationship between being motivated to pre-drink due to the cheaper cost of doing so has important implications for alcohol policy and cost-based methods to reduce excessive alcohol consumption. Future research should continue to investigate the relationship between alcohol cost and modes of consumption in pre-drinking, and in other alcohol consumption research settings.

The AI-IAT significantly predicted scores on the B-YAACQ, indicating that positive implicit alcohol identities are linked to alcohol-related harm. This is consistent with previous research and provides further support for interventions that target implicit influences on behavior (Houben, Havermans, Nederkorn, & Jansen, 2012; Houben, Nederkorn, Wiers, & Jansen, 2011; Houben, Havermans, Remco, & Weirs, 2010). This provides a unique contribution to an important line of research in alcohol consumption interventions, given the challenge of maintaining reductions in excessive drinking in the longer-term (Carey, Scott-Sheldon, Carey, & DeMartini, 2007) and interventions taking a more explicit approach

appear to show inconsistent or no effects on behavior (e.g., normative feedback interventions; see Moreira, Oskrochi, & Foxcroft, 2012). An important caveat of these findings is that the B-YAACQ is a generalised measure of alcohol-related harm that may not reflect consequences of pre-drinking specifically. This may have contributed to some attenuation in the prediction of harm using pre-drinking-specific measures. Although the established links between pre-drinking and increase alcohol-related harm have been noted in recent studies (Hummer, Napper, Ehert, & LaBrie, 2013), we suggest future research is needed to investigate the more proximal consequences of pre-drinking, specifically, to derive a measure of pre-drinking alcohol-related harm.

The correlational design of our study precludes the identification of definitive causal relationships between motive dimensions and the implicit alcohol identity, and our outcome measures. Future research may endeavour to use prospective designs to follow pre-drinkers over longer periods of time to uncover detailed relationships between pre-drinking motives and alcohol-related behaviors. Recruiting our sample from a participant pool in a single university in Australia raises concerns about the generalizability of our findings to the broader pre-drinking student population. Further, that we did not measure the prevalence or frequency with which participants engaged in pre-drinking may be noted as a limitation and important area for future research. However, undergraduate students were the focal population of our study, and our results are somewhat consistent with the themes and trends identified in large-scale Australian research highlighting the importance of social dynamics and cost influencing pre-drinking in Australians in the night-time environment (Miller, 2013). Given that we modelled cost motive as a single-indicator latent variable, the predictive relationships between this and our outcome variables may have been affected. We therefore suggest future research incorporates a more comprehensive measure of cost motive, or that

the prepartying motives inventory is perhaps revised to acknowledge the importance of cost in driving pre-drinking decisions in students.

Conclusions

Specific pre-drinking motive dimensions and self-reported cost motive appear to be related to typical pre-drinking alcohol consumption and alcohol-related harm. In addition, alcohol-related harm was predicted by motive dimensions, cost, and implicit alcohol identity, consistent with an additive pattern from dual systems theory (Perugini, 2005). Specifically, we found that being motivated to pre-drink because of interpersonal enhancement and barriers to consumption at the subsequent event significantly predicted higher typical pre-drinking alcohol consumption and that situational control motives significantly predicted of lower typical pre-drinking alcohol consumption. Alcohol-related harm was significantly predicted by barriers to consumption and situational control, as well as positive implicit alcohol identity. Being motivated by cost was a significant predictor of both typical alcohol consumption and alcohol-related harm. Given our preliminary evidence for the important role that cost plays in motivating pre-drinking in the present study, the importance of financial considerations as a driver of pre-drinking requires further investigation. To our knowledge, this is the first study to investigate the role of implicit processes in pre-drinking as a specific pattern of alcohol consumption. Future research should endeavour to adopt a dual-systems approach to examining pre-drinking and its associated consequences, to inform interventions that reduce excessive alcohol consumption.

All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2000. Informed consent was obtained from all

patients for being included in the study. The authors declare that they have no conflict of interest.

References

- Anderson, Peter, Chisholm, Dan, & Fuhr, Daniela C. (2009). Effectiveness and cost-effectiveness of policies and programmes to reduce the harm caused by alcohol. *The Lancet*, 373(9682), 2234-2246. doi: 10.1016/s0140-6736(09)60744-3
- Barry, Adam E., Stellefson, Michael L., Piazza-Gardner, Anna K., Chaney, Beth H., & Dodd, Virginia. (2013). The impact of pregameing on subsequent blood alcohol concentrations: An event-level analysis. *Addictive Behaviors*, 38(8), 2374-2377. doi: 10.1016/j.addbeh.2013.03.014
- Barton, Adrian, & Husk, Kerryn. (2012). Controlling pre-loaders: alcohol related violence in an English night time economy. *Drugs and Alcohol Today*, 12(2), 89-97. doi: 10.1108/17459261211235119
- Bush, Kristen, Kivlahan, Daniel R, McDonell, Mary B, Fihn, Stephan D, & Bradley, Katharine A. (1998). The AUDIT alcohol consumption questions (AUDIT-C): an effective brief screening test for problem drinking. *Archives of internal medicine*, 158(16), 1789. doi: 10.1001/archinte.158.16.1789
- Byrnes, Joshua M, Cobiac, Linda J, Doran, Christopher M, Vos, Theo, & Shakeshaft, Anthony P. (2010). Cost-effectiveness of volumetric alcohol taxation in Australia. *Med J Aust*, 192(8), 439-443. doi: 10.1111/j.1465-3362.2011.00309.x
- Carey, Kate B., Scott-Sheldon, Lori A. J., Carey, Michael P., & DeMartini, Kelly S. (2007). Individual-level interventions to reduce college student drinking: A meta-analytic review. *Addictive Behaviors*, 32(11), 2469-2494. doi: 10.1016/j.addbeh.2007.05.004
- Churchill, Sue, Jessop, Donna, & Sparks, Paul. (2008). Impulsive and/or planned behaviour: Can impulsivity contribute to the predictive utility of the theory of planned

- behaviour? *British Journal of Social Psychology*, 47(4), 631-646. doi: 10.1348/014466608X284434
- Doran, Christopher M, & Digiusto, Erol. (2011). Using taxes to curb drinking: A report card on the Australian government's alcopops tax. *Drug and Alcohol Review*, 30(6), 677-680. doi: 10.1111/j.1465-3362.2011.00309.x
- Gray, Heather M, LaPlante, Debi A, Bannon, Brittany L, Ambady, Nalini, & Shaffer, Howard J. (2011). Development and validation of the Alcohol Identity Implicit Associations Test (AI-IAT). *Addictive behaviors*, 36(9), 919-926. doi: 10.1016/j.addbeh.2011.05.003
- Greenwald, Anthony G, McGhee, Debbie E, & Schwartz, Jordan LK. (1998). Measuring individual differences in implicit cognition: The implicit association test. *Journal of Personality and Social Psychology*, 74, 1464-1480.
- Hagger, Martin S. (2013a). The multiple pathways by which self-control predicts behavior. *Frontiers in psychology*, 4.
- Hagger, Martin S. (2013b). The opportunity cost model: Automaticity, individual differences, and self-control resources. *Behavioral and Brain Sciences*, 36(06), 687-688.
- Hagger, Martin S, & Chatzisarantis, Nikos LD. (2014). An integrated behavior change model for physical activity. *Exercise and Sport Sciences Reviews*, 42(2), 62-69.
- Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R.E. (2009). *Multivariate data analysis*. Upper Saddle River, NJ: Prentice Hall.
- Hair, J. F., Sarstedt, M., Ringle, C. M., & Mena, J. A. (2012). An assessment of the use of partial least squares structural equation modeling in marketing research. *Journal of the Academy of Marketing Science*, 40(3), 414-433. doi: 07/s11747-011-0261-6
- Hallett, J., Howat, P., Maycock, B., McManus, A., Kypri, Kypros, & Dhaliwal, S. (2012). Undergraduate student drinking and related harms at an Australian university: web-

- based survey of a large random sample. *BMC Public Health*, 12(1), 37. doi: 10.1186/1471-2458-12-37
- Hofmann, Wilhelm, Friese, Malte, & Strack, Fritz. (2009). Impulse and self-control from a dual-systems perspective. *Perspectives on Psychological Science*, 4(2), 162-176. doi: 10.1111/j.1745-6924.2009.01116.x
- Hofmann, Wilhelm, Friese, Malte, & Wiers, Reinout W. (2008). Impulsive versus reflective influences on health behavior: a theoretical framework and empirical review. *Health Psychology Review*, 2(2), 111-137. doi: 10.1080/17437190802617668
- Houben, K., Havermans, R. C., Nederkoorn, C., & Jansen, A. (2012). Beer à no-go: learning to stop responding to alcohol cues reduces alcohol intake via reduced affective associations rather than increased response inhibition. *Addiction*, 107(7), 1280-1287. doi: 10.1111/j.1360-0443.2012.03827.x
- Houben, K., Havermans, R. C., & Wiers, R. W. (2010). Learning to dislike alcohol: conditioning negative implicit attitudes toward alcohol and its effect on drinking behavior. *Psychopharmacology*, 211(1), 79-86. doi: 10.1007/s00213-010-1872-1
- Houben, Katrijn, & Wiers, Reinout W. (2006). Assessing implicit alcohol associations with the Implicit Association Test: Fact or artifact? *Addictive behaviors*, 31(8), 1346-1362. doi: 10.1016/j.addbeh.2005.10.009
- Houben, Katrijn, & Wiers, Reinout W. (2009). Response inhibition moderates the relationship between implicit associations and drinking behavior. *Alcoholism: Clinical and Experimental Research*, 33(4), 626-633. doi: 10.1111/j.1530-0277.2008.00877.x
- Hummer, J. F., Napper, L. E., Ehret, P. E., & LaBrie, J. W. (2013). Event-specific risk and ecological factors associated with prepartying among heavier drinking college students. *Addictive Behaviors*, 38(3), 1620-1628. doi: 10.1016/j.addbeh.2012.09.014

- Keatley, D., Clarke, D. D., & Hagger, M. S. (2012). Investigating the predictive validity of implicit and explicit measures of motivation in problem-solving behavioural tasks. *British Journal of Social Psychology*, 52(5), 510-524. doi: 10.1111/j.2044-8309.2012.02107.x
- Keatley, D., Clarke, D. D., & Hagger, M. S. (2013). The predictive validity of implicit measures of self-determined motivation across health-related behaviours. *British Journal of Health Psychology*, 18(1), 2-17. doi: 10.1111/j.2044-8287.2011.02063.x
- Kock, N. (2012). *WarpPLS 3.0 User Manual* (pp. 55). Retrieved from http://www.scriptwarp.com/warppls/UserManual_WarpPLS_V3.pdf
- Labhart, F., Graham, K., Wells, S., & Kuntsche, E. (2013). Drinking before going to licensed premises: An event-level analysis of predrinking, alcohol consumption, and adverse outcomes. *Alcoholism: Clinical and Experimental Research*, 37(2), 284-291. doi: 10.1111/j.1530-0277.2012.01872.x
- LaBrie, J. W., Hummer, J. F., Pedersen, E. R., Lac, A., & Chithambo, T. (2012). Measuring college students' motives behind prepartying drinking: Development and validation of the prepartying motivations inventory. *Addictive Behaviors*, 37(8), 962-969. doi: 10.1016/j.addbeh.2012.04.003
- Lindgren, K. P., Neighbors, C., Teachman, B. A., Wiers, R. W., Westgate, E., & Greenwald, A. G. (2012). I drink therefore I am: Validating alcohol-related implicit association tests. doi: 10.1016/j.addbeh.2013.01.026
- Lonsdale, Adam J, Hardcastle, Sarah J, & Hagger, Martin S. (2012). A minimum price per unit of alcohol: A focus group study to investigate public opinion concerning UK government proposals to introduce new price controls to curb alcohol consumption. *BMC public health*, 12(1), 1-16.

- MacLean, Sarah, & Callinan, Sarah. (2013). "Fourteen Dollars for One Beer!" Pre-drinking is associated with high-risk drinking among Victorian young adults. *Australian and New Zealand Journal of Public Health*, 37(6), 579-585. doi: 10.1111/1753-6405.12138
- McEachan, R. R. C., Conner, M., Taylor, N. J., & Lawton, R. J. (2011). Prospective prediction of health-related behaviours with the Theory of Planned Behaviour: a meta-analysis. *Health Psychology Review*, 5(2), 97-144. doi: 10.1080/17437199.2010.521684
- Miller, P. G. (2013). Patron Offending and Intoxication in Night-Time Entertainment Districts (POINTED) *Monograph Series 46*. Canberra: National Drug Law Enforcement Research Fund.
- Miller, P. G., & Droste, N. (2013). Alcohol price considerations on alcohol and illicit drug use in university students. *Journal of Alcoholism and Drug Dependence*, 1(109), 2. doi: 10.4172/jaldd.1000109
- Moreira, M. T., Oskrochi, R., & Foxcroft, D. R. (2012). Personalised normative feedback for preventing alcohol misuse in university students: Solomon three-group randomised controlled trial. *PloS one*, 7(9), e44120. doi: 10.1371/journal.pone.0044120
- National Health and Medical Research Council. (2009). *Australian guidelines to reduce risks from drinking alcohol*. Canberra, ACT: Commonwealth of Australia Retrieved from http://www.nhmrc.gov.au/_files_nhmrc/publications/attachments/ds10-alcohol.pdf.
- Ostafin, Brian D, & Palfai, Tibor P. (2012). When wanting to change is not enough: automatic appetitive processes moderate the effects of a brief alcohol intervention in hazardous-drinking college students. *Addiction Science & Clinical Practice*, 7(1), 1-9. doi: 10.1186/1940-0640-7-25

- Pedersen, E. R., & LaBrie, J. (2007). Partying before the party: Examining prepartying behavior among college students. *Journal of American College Health*, 56(3), 237-245. doi: 10.3200/JACH.56.3.237-246
- Pedersen, E. R., LaBrie, J. W., & Kilmer, J. R. (2009). Before you slip into the night, you'll want something to drink: exploring the reasons for prepartying behavior among college student drinkers. *Issues in Mental Health Nursing*, 30(6), 354-363. doi: 10.1080/01612840802422623
- Perugini, Marco. (2005). Predictive models of implicit and explicit attitudes. *The British Journal of Social Psychology*, 44(1), 29-45. doi: 10.1348/014466604X23491
- Read, J. P., Merrill, J. E., & Bytschkow, K. (2010). Before the party starts: risk factors and reasons for "pregaming" in college students. *Journal of American College Health*, 58(5), 461-472. doi: 10.1080/07448480903540523
- Rose, Paul, Smith, Shannon Toney, & Segrist, Daniel J. (2010). Too cheap to chug: frugality as a buffer against college-student drinking. *Journal of Consumer Behaviour*, 9(3), 228-238. doi: 10.1002/cb.314
- Sheeran, Paschal, Gollwitzer, Peter M, & Bargh, John A. (2013). Nonconscious processes and health. *Health Psychology*, 32(5), 460.
- Skov, Steven J, Chikritzhs, Tanya N, Kypri, Kypros, Miller, Peter G, Hall, Wayne D, Daube, Michael M, & Moodie, A Rob. (2011). Is the "alcopops" tax working? Probably yes but there is a bigger picture. *Medical journal of Australia*, 195(2), 84-86.
- Slutske, Wendy S., Hunt-Carter, Erin E., Nabors-Oberg, Rachel E., Sher, Kenneth J., Bucholz, Kathleen K., Madden, Pamela A. F., . . . Heath, Andrew C. (2004). Do college students drink more than their non-college-attending peers? Evidence from a population-based longitudinal female twin study. *Journal of Abnormal Psychology*, 113(4), 530-540.

Strack, F., & Deutsch, R. (2004). Reflective and impulsive determinants of social behavior.

Personality and Social Psychology Review, 8(3), 220-247. doi:

10.1207/s15327957pspr0803_1

Tenenhaus, M., Amato, S., & Vinzi, V. E. (2004). *A global goodness-of-fit index for PLS structural equation modelling*. Paper presented at the XLII SIS Scientific Meeting, 2004, Padova, Italy. .

Vinzi, V. E., Chin, W. W., Henseler, J., & Wang, H. (2010). *Handbook of Partial Least Squares : Concepts, Methods and Applications*. New York, USA: Springer.

Wiers, R. W., Bartholow, B. D., van den Wildenberg, E., Thush, C., Engels, R. C. M. E., Sher, K. J., . . . Stacy, A. W. (2007). Automatic and controlled processes and the development of addictive behaviors in adolescents: a review and a model.

Pharmacology Biochemistry and Behavior, 86(2), 263-283. doi:

10.1016/j.pbb.2006.09.021

Table 1

Correlations between study variables.

	1	2	3	4	5	6	7	8	9
1. IP	(.873)								
2. IE	.394**	(.788)							
3. BTC	.391**	.514**	(.881)						
4. SC	.262**	.418**	.611**	(.794)					
5. AI-IAT	.076	.239*	.095	-.082	-				
6. PDAC	.207*	.429**	.296**	.137	.272**	-			
7. Cost	.188*	.592**	.338**	.427**	.264**	.519**	-		
8. B-YAACQ	.251**	.366**	.349**	.143	.314**	.315**	.316**	-	
9. AC Freq	-.028	.175*	.080	-.177	.306**	.121	.166*	.159	-

Note. Latent variable VAVE (average variance extracted) are presented on the principal diagonal. AI-IAT = alcohol identity implicit association test; IP = intimate pursuit;

IE = interpersonal enhancement; BTC = barriers to consumption; SC = situational control; B-YAACQ = total scores on brief young adult alcohol consequences scale;

PDAC = typical pre-drinking alcohol consumption; AC Freq = alcohol consumption frequency. * $p < .05$ ** $p < .01$

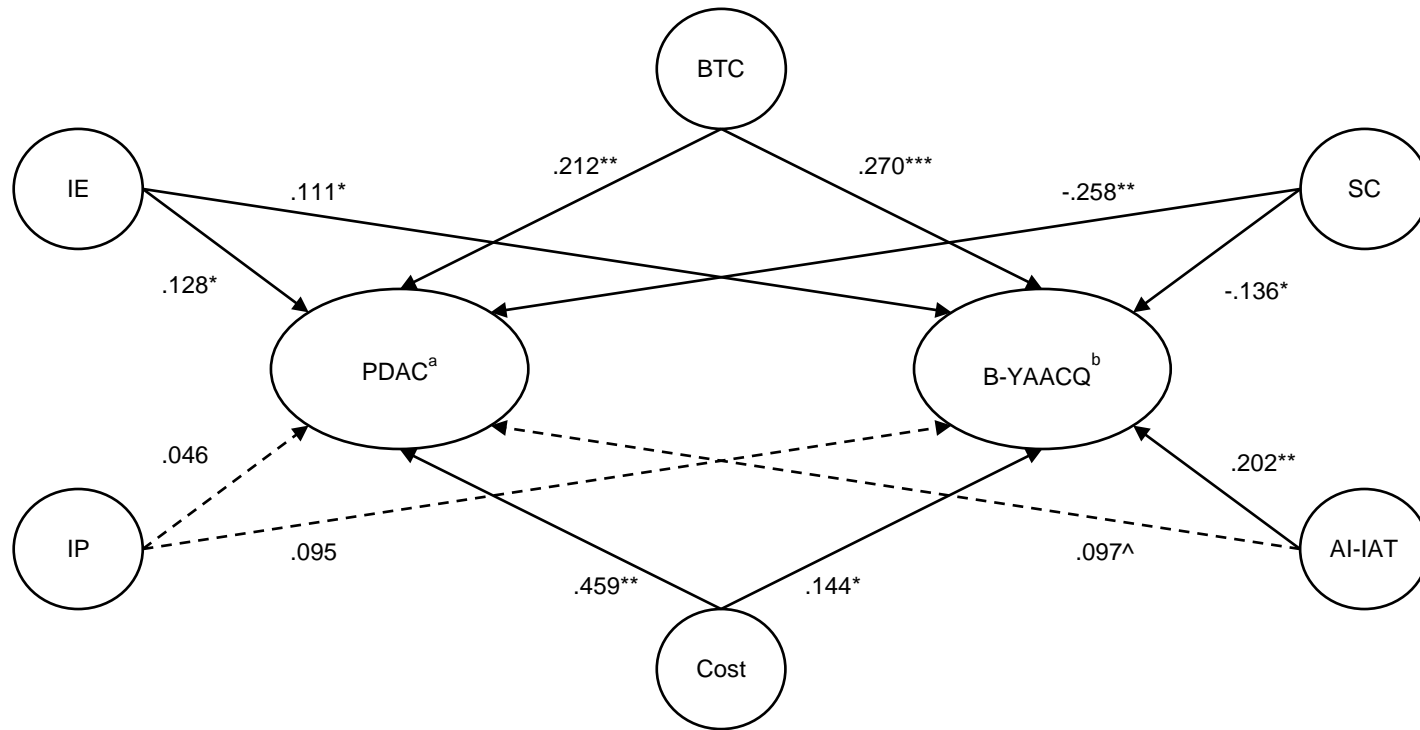


Figure 1. Path model showing the standardised regression coefficients between motive dimensions from the PMI, cost, and the AI-IAT.

Note. $*p < .05$ $**p < .01$. $^aR^2 = .258$; $^bR^2 = .307$. IP = intimate pursuit; IE = interpersonal enhancement; SC = situational control; BTC = barriers to consumption; AI-IAT = alcohol identity implicit association test; PDAC = typical pre-drinking alcohol consumption; B-YAACQ = brief young adult alcohol consequences scale. ^aAlthough the path from AI-IAT to B-YACCQ was not statistically significant ($p = .07$), the effect size ($f^2=.03$) suggests a significant, albeit small, effect was present with insufficient statistical power to confirm it.

**CHAPTER IV: REDUCING ALCOHOL CONSUMPTION DURING PRE-
DRINKING SESSIONS: TESTING AN INTEGRATED BEHAVIOUR-CHANGE
MODEL**

This chapter includes a manuscript detailing the application of an integrated behaviour-change model, comprising motivational and social cognitive constructs, to the prediction of undergraduates' intentions to reduce their alcohol consumption when engaging in pre-drinking, and their subsequent pre-drinking alcohol consumption. The manuscript is presented as a chapter in its submitted format.

Reducing alcohol consumption during pre-drinking sessions: Testing an integrated
behaviour-change model

Kim M. Caudwell¹, Jacob J. Keech², Kyra Hamilton^{2,1}, Barbara A. Mullan^{1,3}, Martin
S. Hagger^{1,2}

¹Health Psychology and Behavioural Medicine Research Group, School of Psychology and
Speech Pathology, Faculty of Health Sciences, Curtin University, Perth, Western Australia

²School of Applied Psychology, Griffith University, Mt. Gravatt, Brisbane, Queensland,
Australia.

³School of Psychology, University of Sydney, Sydney New South Wales, Australia

Abstract

Objective: Pre-drinking (consuming alcohol prior to attending a subsequent event) increases the risk of alcohol-related harm, and is common in undergraduate student populations. The current study tested an integrated behaviour change model to identify the motivational, social-cognitive, and implicit predictors of pre-drinking behaviour.

Design: University students (N = 289) completed an online questionnaire comprising measures of motivational and social-cognitive constructs related to reducing pre-drinking alcohol consumption and past behaviour, and an implicit association test for alcohol identity.

Participants reported their pre-drinking alcohol consumption at follow-up, four weeks from baseline.

Main Outcome Measures: Self-reported pre-drinking alcohol consumption.

Results: A variance-based structural equation model revealed that few of the hypothesised relationships were supported. Follow-up pre-drinking alcohol consumption was significantly predicted by past behaviour, perceived behavioural control, and implicit alcohol identity, but not by intention.

Conclusion: Current findings indicate pre-drinking is predicted by perceived behavioural control and implicit identity and not intentions. Interventions should consider these factors and attempt to strengthen the relationship between intentions to reduce pre-drinking and reductions in pre-drinking behaviour.

Keywords: pre-drinking; alcohol; self-determination theory; theory of planned behaviour; dual-systems model

Introduction

Pre-drinking is defined as the consumption of alcohol prior to attending a subsequent event, where alcohol consumption often continues (Pedersen & LaBrie, 2007), and has been linked to greater risk of alcohol-related harm. Pre-drinkers have higher blood alcohol concentrations than those who do not pre-drink (Barry, Stellefson, Piazza-Gardner, Chaney, & Dodd, 2013). Further, approximately 25% of pre-drinkers report becoming unconscious during a pre-drinking session within the previous month (LaBrie, Hummer, Kenney, Lac, & Pedersen, 2011) and are also more likely to report experiencing violent incidents within the previous twelve months (Miller et al., 2015). Pre-drinking is prevalent in university student populations, which also have higher overall rates of excessive alcohol consumption compared to non-student populations (Burns et al., 2015; Hallett, McManus, Maycock, Smith, & Howat, 2014; Kypri, Cronin, & Wright, 2005). Research related to pre-drinking has generally focused on its prevalence, and relationship to alcohol-related harm (Miller et al., 2015; Wells, Graham, & Purcell, 2009), as well as understanding pre-drinkers' motives that reflect perceived practical and social benefits of engaging in pre-drinking (LaBrie, Hummer, Pedersen, Lac, & Chithambo, 2012). However, there appears to be a relative dearth of pre-drinking research that incorporates psychological theories of motivation and social cognition (Foster & Ferguson, 2013). For example, the theory of planned behaviour (Ajzen, 1991, 2015) has been widely applied to investigate excessive patterns of alcohol consumption in a wide range of settings (Cooke, Dahdah, Norman, & French, 2014). Research that applies psychological theories is integral to the development of psychological theory-based behaviour change interventions (Hamilton & Hagger, 2014).

Recently, Hagger and Chatzisarantis (2014) have proposed an integrated behaviour change model which represents recent developments in synthesising research findings from two psychological theories: self-determination theory (Deci & Ryan, 1985), and the theory of planned behaviour (Ajzen, 1991). Self-determination theory concerns the quality of motivation in influencing behavioural engagement, whereby motivation exists on a continuum from more *controlled* (less self-determined) to *autonomous* (more self-determined) forms. Where controlled motivation refers to external regulations for engaging in behaviour (e.g., because of some extrinsic reward, or to avoid feelings of guilt or shame), autonomous motivation refers to more internal regulations (e.g., because of some intrinsically meaningful reward, or for enjoyment). The theory of planned behaviour states that *intention* (the sum of motivation towards behavioural engagement) is a direct predictor of behaviour,

and is shaped by belief-based evaluations – *attitude* towards engaging in the behaviour; the *subjective norm*, or perceived social influence related to behavioural engagement, and *perceived behavioural control* (i.e., over behavioural engagement). Integration of these theories is based on their complementary explanations of behaviour - self-determination theory presents the motivational basis for behavioural engagement but does not clarify how motivation leads to action, whereas the theory of planned behaviour presents belief-based evaluations that influence intention (i.e., attitude, subjective norm, perceived behavioural control) but is not concerned with how these beliefs are formed (Hagger & Chatzisarantis, 2009). The result of integration is a framework where autonomous motivation influences attitude, subjective norm, and perceived behavioural control, which in turn influences intention. For example, an individual may consider reducing pre-drinking alcohol consumption for its valued benefits (e.g., health outcomes), then forming positive attitudes towards reducing future reductions in pre-drinking alcohol consumption (e.g., that doing so would be beneficial, or good), influencing their intentions accordingly. However, it is important to note that controlled motivation may be especially relevant to the formation of belief-based evaluations that underlie intentions to consume alcohol (Chawla, Neighbors, Logan, Lewis, & Fossos, 2009; Knee & Neighbors, 2002). Similarly, an individual may have an external rationale for reducing pre-drinking alcohol consumption (e.g., a friend or family member wanting them to), which is associated with feelings of guilt or shame at the thought of failure to do so. The individual is, therefore, more likely to form beliefs consistent with this external rationale, which is consistent with the conceptualization of subjective norm as comprising external influences to act (e.g., people who are important to me would want me to reduce my pre-drinking alcohol consumption) and intention. Caudwell and Hagger (2015) applied a model based on this premise to predict students' intentions to engage in pre-drinking sessions, finding students formed their pre-drinking intentions consistent with autonomous motivation and attitudes towards pre-drinking, with intention and perceived behavioural control predicting engagement in pre-drinking sessions over a four-week period.

An important advancement of Hagger and Chatzisarantis' (2014) integrated behaviour change model is the incorporation of reflective and impulsive components from dual-systems theories (Hofmann, Friese, & Wiers, 2008; Strack & Deutsch, 2004). While a reflective, deliberative route incorporates an individual's motivation and social cognitions (e.g., autonomous motivation, attitude, intentions, subjective norms), an impulsive, non-conscious route to behaviour incorporates learned cue-response associations, typically measured using

reaction-time-based tasks that infer associations beyond conscious awareness (Strack & Deutsch, 2004). Increasing evidence has shown that the impulsive system plays an important role in determining health behaviour, as more reflective psychological constructs, (e.g., from motivational and social cognition theories) are not ubiquitously influential (Hagger, 2016). A noted limitation of reflective constructs is demonstrated by research concerning intention-behaviour “gap”, and issues with *inclined abstainers* (Orbell & Sheeran, 1998) – individuals who intend to act, yet do not do so. When intention is low, or shows modest prediction of behaviour, impulsive processes may override these intentions, or showing stronger prediction of behaviour (Hofmann, Friese, & Strack, 2009; Hofmann et al., 2008). An expanding body of research has examined the influence of impulsive processes on health behaviour, such as a motivation-specific implicit association test, and an implicit association test related to alcohol identity (Caudwell & Hagger, 2014; Keatley, Clarke, & Hagger, 2013; Lindgren et al., 2012). The inclusion of measures of impulsive processes, alongside reflective measures of motivational and social cognitive constructs related to individuals’ reducing pre-drinking alcohol consumption has yet to be investigated.

The aim of the present study was, therefore, to apply an integrated behaviour change model to pre-drinking, to better understand reflective and impulsive constructs underlying individuals’ pre-drinking alcohol consumption. The present study will make a unique contribution to knowledge, as it is the first to apply a newly-proposed integrated model based on multiple theoretical perspectives on health behaviour to health behaviour, and is also the first to apply the model to pre-drinking behaviour, a pattern of alcohol consumption that has rarely been studied, particularly in studies adopting a theoretical approach. Given previous research which has revealed effects of explicit social cognitive, motivational and volitional constructs as well as implicit factors on alcohol consumption behaviour, it seemed that this model may be an effective means to explain a related pattern of alcohol consumption, pre-drinking, by bringing the different components from the theories together. A series of hypotheses were formulated based on the posited relationships of the integrated behaviour-change model and research from its component theories. We hypothesised that autonomous motivation would positively predict attitude, subjective norm, perceived behavioural control, and intention (H_1). The relationship between autonomous motivation and subjective norm was proposed as it may reflect autonomy-supportive influences from important social referents, consistent with previous research findings (Chawla et al., 2009; Hagger, 2009). Controlled motivation was hypothesised to predict attitude, subjective norm, perceived

behavioural control, and intention (H_2). While previous research has shown an effect of controlled motivation on attitude, the size of the effect was expected to be smaller than that of autonomous motivation on attitudes (Caudwell & Hagger, 2015; Hagger et al., 2011). The relationship between controlled motivation and perceived behavioural control was expected to be negative, given the former reflects pressuring rather than self-determined reasons for engaging in behaviour and that perceived behavioural control likely reflects perceptions of competence with the behaviour, a defining characteristic of autonomous forms of motivation. Controlled forms of motivation may reflect a lack of satisfaction of the need for competence and, therefore, would be expected to be associated with lower perceived competence regarding participating in the behaviour in future (Knee & Neighbors, 2002). Consistent with the theory of planned behaviour, attitude, subjective norm, and perceived behavioural control were hypothesised to predict intention (H_3), and intention and perceived behavioural control were hypothesised to predict pre-drinking alcohol consumption (H_4), where perceived behavioural control approximated actual control.

We used an implicit association test that measures alcohol identity, to represent a construct from the impulsive system (Lindgren et al., 2012). Implicit alcohol identity has been recently found to predict a range of alcohol-related outcomes (e.g., consumption, expenditure, and harm), demonstrates strong internal consistency and test-retest reliability, and has been studied in university student samples (Lindgren, Foster, Westgate, & Neighbors, 2013; Lindgren, Neighbors, et al., 2016; Lindgren et al., 2012; Lindgren, Ramirez, Olin, & Neighbors, 2016; Ramirez, Dennhardt, Baldwin, Murphy, & Lindgren, 2016). We therefore hypothesised that implicit alcohol identity would predict pre-drinking alcohol consumption at follow-up (H_5).

In terms of the relationships between model constructs, we hypothesised that the effect of autonomous motivation on intention would be mediated by attitude, subjective norm, and perceived behavioural control (H_6), and the effect of controlled motivation on intention would be mediated by attitude, subjective norm, and perceived behavioural control (H_7). However, we expected the indirect effects of controlled motivation on intention to be relatively weak, compared with those of autonomous motivation on intention. Figure 1 depicts the hypothesised relationships between model constructs.

Method

Participants

Participants were students recruited from two Australian universities as part of an ongoing collaboration between the universities with intention to maximise recruitment. Students opting to participate in return for course credit and the study advertised on flyers displayed around campuses. Eligibility criteria were that participants had to be current drinkers, who had engaged in pre-drinking within the previous twelve months. The study was approved by respective university human research ethics committees. Participants were directed to a webpage providing information about the study, before proceeding to an electronic consent form that informed participants that clicking ‘next’ indicated they were providing consent to participate. The study was correlational in design, with participants completing theory-based and pre-drinking alcohol consumption measures at baseline, and invited via automated email to complete the same pre-drinking alcohol consumption behavioural measures at follow-up, four weeks later.

Participants (total $N = 289$, 76.50% female, $M_{\text{age}} = 20.11$ years, $SD = 2.37$ years) were undergraduate students from Australian universities, in Western Australia ($n = 132$; 75.80% female; $M_{\text{age}} = 19.92$, $SD_{\text{age}} = 2.74$ years) and Queensland ($n = 157$; 77.10% female; $M_{\text{age}} = 20.28$ years, $SD_{\text{age}} = 2.00$ years). Most of the participants identified as Caucasian Australian (Western Australian sample = 73.50%; Queensland sample = 79.00%) and the majority reporting consuming alcohol at least once a month (Western Australian sample = 87.10%; Queensland sample = 72.00%). Participants from Western Australia reported studying in the Faculty of Health Sciences ($n = 117$; 88.60%) with a small minority of participants studying on programmes from multiple faculties ($n = 12$; 9.10%), and other Faculties ($n = 3$; 3.10%). The majority of participants from Queensland reported studying in the Health Sciences faculty ($n = 65$; 41.40%), followed by students studying on programs in combined faculties ($n = 36$; 22.90%), the Arts, Education and Law faculty (26; 16.50%), and Sciences faculty ($n = 16$; 10.20%). There were no differences between the typical pre-drinking alcohol consumption of Western Australian ($M = 6.03$, $SD = 2.93$) and Queensland ($M = 5.80$, $SD = 4.35$) university students: $t(287) = .52$, $p = .605$, nor were there any differences between faculties in terms of the distributions of typical pre-drinking frequency (Western Australia: $\chi^2(3) = 4.01$, $p = .261$; Queensland: $\chi^2(6) = 3.97$, $p = .680$) or typical pre-drinking alcohol consumption (Western Australia: $\chi^2(3) = 2.44$, $p = .486$; Queensland: $\chi^2(7) = 3.01$, $p = .798$).

Measures

A complete list of measures included in the appendix.

Theory of planned behaviour constructs. Measures followed Ajzen's (2002) guidelines in relation to target, context, action and time (i.e., *reducing alcohol consumption during pre-drinking sessions over the next four weeks*), adapted from previous research (Caudwell & Hagger, 2015). Five items were used to measure participants' attitudes towards reducing their pre-drinking over the next four weeks. Bipolar statements with a common stem (e.g., "*reducing my alcohol consumption during pre-drinking sessions over the next four weeks would be...*") were presented, with participants indicating their response (e.g., *bad* [1] – *good* [6]). Four items were used to measure subjective norm (e.g., "*People whose opinions I value would want me to reduce my alcohol consumption during pre-drinking sessions over the next four weeks*"), with participants indicating their agreement on a Likert scale ranging from 1 (*disagree very strongly*) to 6 (*agree very strongly*). Four items were used to measure perceived behavioural control (e.g., "*Reducing my alcohol consumption during pre-drinking sessions over the next four weeks is up to me*"), and three items were used to measure intentions (e.g., "*I intend to reduce my pre-drinking alcohol consumption over the next four weeks*"), using the same agreement response scale.

Self-determination theory constructs. Statements based on the perceived locus of causality scale and adapted for pre-drinking were used (see Caudwell & Hagger, 2015). Participants responded to a series of statements reflecting motivational regulations for reducing pre-drinking alcohol consumption. Statements reflecting identified regulation (e.g., "*I reduce my alcohol consumption during pre-drinking sessions because I value the benefits*") and intrinsic motivation (e.g., "*It is enjoyable to reduce my alcohol consumption during pre-drinking sessions*") were used. Statements reflecting extrinsic motivation (e.g., "*I reduce my alcohol consumption during pre-drinking sessions because I will feel guilty or embarrassed if I do not*") and introjected regulation (e.g., "*I reduce my alcohol consumption during pre-drinking sessions because other people say I should*") were used to reflect controlled motivation. Participants were asked to indicate how true these statements were of them, on a Likert scale ranging from 1 (*not at all true*) to 4 (*very true*).

Implicit alcohol identity. The alcohol identity implicit association test (AI-IAT) is a variation on the computerised implicit association test paradigm, which requires participants to sort word stimuli presented in the centre of the screen into corresponding categories, using specified keyboard commands corresponding to left (*e*) or right (*i*) sides of the screen. The task comprises seven blocks, each comprising twenty trials. Specifically, blocks comprise the categories *drinker* (i.e., *drink*, *drinker*, *drunk*, *partier*) and *non-drinker* (i.e., *abstain*,

abstainer, non-drinker, sober); and/or the categories *me* (i.e., *me, mine, my, myself*) and *not me* (e.g., *theirs, them, they, others*). Blocks 1, 2, and 5 require the participant to sort word stimuli (e.g., *my*) into one of two categories (e.g., *me* or *not me*). Blocks 3 and 4, and 6 and 7, require the participant to sort word stimuli (e.g., *my* or *drunk*) into one of two paired categories (e.g., *drinker + me*, or *non-drinker + not me*). Blocks 6 and 7 differ from blocks 3 and 4, in that the side of the screen is switched for the *me* and *not me* categories. Response latencies for each trial are compared for blocks 3 and 4, and 6 and 7, revealing bias towards a certain category/attribute pairing (e.g., participants may take less time to sort words, and make fewer errors, in blocks where *drinker + me* and *non-drinker* and *not me* pairings are used). The resulting metric, termed a D-score (Greenwald, Nosek, & Banaji, 2003), is calculated based on a series of steps and established inclusion/exclusion criteria for trials and participants. Trials longer than 10,000ms are excluded from the calculation (i.e., they are too long to be considered accurate or implicit), and participants for whom more than 10% of trials exhibit a response latency less than 300ms are excluded (i.e., they are likely non-compliant). Positive D-scores indicate quicker associations with *drinker + me* pairings; negative scores indicate quicker associations to *drinker + not me* pairings.

The AI-IAT procedure was administered online, consistent with previous research (Caudwell & Hagger, 2014). Internal consistency reliability coefficients for the AI-IAT was .42 for the Western Australian sample, and .50 for the Queensland sample, with the former coefficient slightly lower than those observed in previous research (Greenwald et al., 2003).

Pre-drinking alcohol consumption. At baseline (past behaviour) and follow-up, participants reported the standard drinks³ they had consumed during pre-drinking sessions per week, over the previous four weeks. Consistent with previous approaches, participants were shown a pictorial guide adapted from the National Health and Medical Research Council (NHMRC, 2009) to aid in their standard drink estimates (Black & Mullan, 2015; Caudwell & Hagger, 2015).

Analytic Method

We used partial least squares-based structural equation modelling (PLS-SEM) to test the hypothesised relationships in the integrated behaviour change model (see Figure 1). The PLS-SEM analysis comprises two models: a measurement, or outer model; and, a structural,

³ A 'standard drink' differs between countries. In Australia, a standard drink is a beverage that contains 10g of ethanol, compared to 14g in the United States, and 8g in the United Kingdom (Furtwaengler & Visser, 2013).

or inner model (Hair, Hult, Ringle, & Sarstedt, 2013). The measurement model consists of the relationships between latent constructs (also termed latent variables) and their indicators – in this case, from the integrated theoretical model (i.e., questionnaire items), and is evaluated based on criteria associated with the reliability of indicators and their loadings on respective and other constructs. The structural model consists of relationships between variables (e.g., Figure 1), represented by standardised path coefficients (β), associated statistical significance values (p), and effect sizes (f^2), and is evaluated by observing a range of metrics related to the suitability of the model in predicting variance in endogenous, or dependent variables (Kock, 2015).

Variance-based structural equation modelling was selected as it is a distribution-free modelling method (i.e., data need not meet distributional assumptions), making it adequate for use with alcohol consumption data (Hair, Ringle, & Sarstedt, 2011; Neal & Simons, 2007). Results of PLS-SEM analyses are similar to covariance-based approaches, and are considered well-suited to theory testing and applications in psychological research (Hair et al., 2013; Willaby, Costa, Burns, MacCann, & Roberts, 2015). Further, mediation analyses can be conducted in PLS-SEM by isolating the path of interest, and comparing the indirect and total effects (Kock, 2015). Using this method, a significant indirect and total effect is indicative of partial mediation, and a significant indirect and total effect in the absence of a significant direct effect is indicative of complete mediation (Kock, 2011).

A series of criteria have been recommended to evaluate PLS-SEM analyses, related to the convergent and discriminant validity of the outer model, and the predictive relationships between latent variables in the inner model (Kock, 2015; Vinzi, Chin, Henseler, & Wang, 2010). To satisfy convergent validity, both Cronbach's alpha and composite reliability coefficients for each factor must exceed .70, and the average variance extracted (AVE) in each factor must exceed .50. To satisfy discriminant validity, the square root of the average variance extracted (\sqrt{AVE}) for each factor must exceed its correlation with other factors in the model (Fornell & Larcker, 1981). A resampling algorithm is recommended to increase the stability of path coefficients between variables, and reduce standard errors when estimating the model (Kock, 2015). It is also necessary that both the average block variance inflation factor (AVIF) and average full collinearity variance inflation factor (AFVIF) are less than or equal to 3.30, indicating little influence of variable collinearity and multicollinearity (Kock, 2015). Finally, a suitable inner model comprises a statistically significant average path coefficient (APC) and adjusted average R^2 (AAR^2). A Goodness of Fit statistic (Tenenhaus,

Amato, & Vinzi, 2004) has been developed for PLS-SEM, however its use and interpretation is subject to debate (Hair et al., 2013). Individual model hypotheses were tested via the evaluation of standardised path coefficients (β) between proposed constructs in the model and their associated effect size, analogous to Cohen's (1988) f^2 statistic (Kock, 2015), whereby effect sizes of .02, .15, and .35 are interpreted as small, medium, and large, respectively.

In terms of model specification, we assigned items to indicate each respective latent factor underlying the integrated model (e.g., the latent variable 'attitude' was indicated by the five attitude items). Attitude, subjective norm, perceived behavioural control, and intention factors, were indicated by their respective items in this way. The autonomous motivation factor was indicated by items measuring intrinsic motivation and identified regulation to reduce pre-drinking alcohol consumption, whereas the controlled motivation factor was indicated by items measuring extrinsic and introjected regulation to reduce pre-drinking alcohol consumption (Vansteenkiste, Simons, Lens, Sheldon, & Deci, 2004). Gender (coded as 1 = male, 2 = female), sample (coded as 1 = Western Australia, 2 = Queensland), age, and AI-IAT D-score were estimated as single-item latent factors. The past behaviour (i.e., baseline pre-drinking alcohol consumption) and follow-up pre-drinking alcohol consumption factors were each indicated by four items representing pre-drinking alcohol consumption for the four weeks prior to baseline and follow-up. We controlled for baseline pre-drinking alcohol consumption, age, gender, and sample, by drawing paths from these factors to all other latent factors in the model, consistent with previous approaches (Caudwell & Hagger, 2015; Kock, 2011)⁴.

Results

Preliminary analyses

We conducted a preliminary analysis to detect the extent of bias across University samples in demographic and psychological measures. A one-way MANOVA revealed a statistically significant main effect for state on model variables, $F(10, 265) = 5.325, p < .001$; partial $\eta^2 = .17$. Statistically significant differences were observed between averaged item means for autonomous motivation (Western Australia sample: $M = 1.81, SD = .61$; Queensland sample: $M = 2.00, SD = .76$; $F(1,274) = 4.72, p = .031$, partial $\eta^2 = .02$), perceived behavioural control (Western Australia sample: $M = 5.19, SD = .73$; Queensland sample: $M = 5.62, SD = .51$; $F(1,274) = 33.24, p < .001$, partial $\eta^2 = .11$), follow-up pre-

⁴ Relationships between control and model variables are available in the online supplementary materials

drinking alcohol consumption (Western Australia sample: $M = 3.89$, $SD = 9.29$; Queensland sample: $M = 2.03$, $SD = 4.23$; $F(1,274) = 4.82$, $p = .029$, partial $\eta^2 = .02$), and implicit alcohol identity (Western Australia sample: $M = .36$, $SD = .44$; Queensland sample: $M = .24$, $SD = .45$, $F(1,274) = 5.03$, $p = .026$, partial $\eta^2 = .02$), although the effect sizes for the differences were small. No significant gender differences between samples were observed, $\chi^2(1) = .07$; $p = .793$, nor were there differences in age between samples: $t(287) = -1.30$, $p = .194$. Attrition analyses using averaged item scores from model variables indicated no difference between participants who dropped out (WA = 162, Qld = 81) or remained (WA = 132, Qld = 157) in the study: Western Australia sample: $F(9,284) = 1.90$, $p = .052$, partial $\eta^2 = .06$; Queensland sample: $F(9,228) = .95$, $p = .487$, partial $\eta^2 = .04$). The samples were combined for analyses with PLS-SEM; descriptive statistics for the pooled sample are included in Table 1⁵.

Model evaluation

Internal reliability and discriminant validity indices met the established criteria (see Table 1). Regarding internal reliability, Cronbach's alpha scores ranged from .74 to .98, composite reliability scores, based on the factor loadings, ranged from .84 to .99, and the AVE for each factor exceeded .50 ($M_{AVE} = .68$; $SD_{AVE} = .14$), indicating acceptable convergent validity. Regarding discriminant validity, \sqrt{AVE} for each factor exceeded that factor's correlation with other factors. The AVIF and AFVIF values were below the recommended cut-off value of 3.50 (Kock, 2015), indicating no issues with variable collinearity and multicollinearity. Both the APC (.11) and AAR² (.18) were statistically significant ($p < .001$), and the Tenenhaus Goodness of Fit (Tenenhaus et al., 2004) was .37 (large), indicating that the model represented good fit with these data. Overall, the model accounted for 47% of the variance in intention to reduce pre-drinking alcohol consumption, and 22% of the variance in pre-drinking alcohol consumption at follow-up.

Path coefficients

Figure 2 shows the statistically-significant direct path coefficients in the integrated behaviour change model, controlling for gender⁶, source, and past behaviour. Autonomous motivation significantly predicted attitude with a medium effect size ($\beta = .42$, $p < .001$, $f^2 = .20$), subjective norm with a small effect size ($\beta = .18$, $p = .001$, $f^2 = .05$), perceived

⁵ For analyses of the pattern of effects between samples, the reader is referred to Appendix E.

⁶ We tested whether the model paths and pattern of relationships hypothesised in the integrated behaviour-change model differed by gender. Using Satterthwaite Approximation and pooled standard error approaches to compare the path coefficients from each model (Kock, 2014), we found no statistically significant differences.

behavioural control with a small effect size ($\beta = .12, p = .019, f^2 = .03$), and intention with a small effect size ($\beta = .23, p < .001, f^2 = .12$) supporting H₁. Controlled motivation significantly predicted subjective norm, with a small effect size ($\beta = .29, p < .001, f^2 = .11$), and also significantly predicted intention ($\beta = .12, p = .022, f^2 = .05$), with a small effect size. Although controlled motivation did not significantly predict attitude ($\beta = .10, p = .052, f^2 = .03$)⁷, it significantly negatively predicted perceived behavioural control ($\beta = -.23, p < .001, f^2 = .07$), with a small effect size. Therefore, H₂ was supported for the effect of perceived control but not attitude. Attitude was the only significant predictor of intention, with a medium effect size ($\beta = .43, p < .001, f^2 = .27$); intention was not significantly predicted by subjective norm ($\beta = .07, p = .124, f^2 = .03$) or perceived behavioural control ($\beta < .01, p = .496, f^2 < .01$), providing limited support for H₃. Intention did not significantly predict pre-drinking behaviour ($\beta = .03, p = .296, f^2 < .01$)⁸, however perceived behavioural control statistically significantly and directly predicted pre-drinking alcohol consumption with a small effect size ($\beta = -.18, p < .001, f^2 = .04$), providing only partial support for H₄. Implicit alcohol identity statistically significantly and directly predicted pre-drinking alcohol consumption with a small effect size ($\beta = .11, p = .026, f^2 = .01$), providing support for H₅. It should be noted that past behaviour (baseline pre-drinking alcohol consumption) significantly predicted follow-up pre-drinking alcohol consumption with a small effect size ($\beta = .35, p < .001, f^2 = .14$).

Mediation analyses

Support for only one of the proposed mediation effects was found. Attitude partially mediated the effect of autonomous motivation on intention (direct effect = .23, Cohen's $f^2 = .12; p < .001$; indirect effect = .18, Cohen's $f^2 = .09, p < .001$; total effect = .47, Cohen's $f^2 = .24; p < .001$), with small-to-medium effect sizes, providing support for this effect from H₆. Given that the remainder of the proposed mediation effects were not supported, as evidenced

⁷We tested a model excluding the 61 participants who reported consuming alcohol less than once a month ($n = 228$). Results revealed similar patterns of effects to the overall sample, with slightly larger Beta values associated with the PBC – PDAC ($\beta = -.26, p < .001, f^2 = .06$) and D – PDAC ($\beta = .16, p = .009, f^2 = .02$) paths. The effect of controlled motivation on attitude was also statistically significant ($\beta = .11, p = .049, f^2 = .04$), when it was not significant in the overall sample.

We also tested a model excluding the 52 participants who reported did not report consuming alcohol during pre-drinking sessions at baseline ($n = 237$). Results revealed similar patterns of effects to the overall sample, with the following differences: the controlled motivation – intention path was statistically non-significant ($\beta = .03, p = .301, f^2 = .01$); the subjective norm to intention path was statistically significant ($\beta = .11, p = .037, f^2 = .05$); autonomous motivation to PBC was statistically non-significant ($\beta = .08, p = .098, f^2 = .01$); and the controlled motivation – attitude was statistically significant ($\beta = .14, p = .017, f^2 = .05$) in this sample.

⁸The zero-order correlation between intention and behaviour was also non-significant ($r < .01, p = .956$).

by non-significant direct effects (i.e., there was no effect to mediate), and/or non-significant indirect effects (i.e., the effect was not mediated), these results have been included in the supplementary materials.

Discussion

The aim of the present study was to test the motivational, social cognitive, and implicit factors that influence intentions to reduce pre-drinking alcohol consumption and subsequent behaviour. We found limited support for the proposed relationships between constructs with the exception of the partial mediation of the effect of autonomous motivation on intention through attitude, and the direct effects of perceived behavioural control and implicit alcohol identity on behaviour. The lack of an intention-behaviour relationship provides limited support for the integrated behaviour change model in predicting pre-drinking alcohol consumption (Ogden, 2003; Weinstein, 2007). However, results offer an important contribution to the understanding of the predictors of pre-drinking alcohol consumption, most importantly, that of perceived behavioural control and implicit alcohol identity. The latter finding justifies our decision to adopt a model incorporating dual processes. Had we selected an approach based solely on social cognitive and motivational factors would have failed to find impact of the implicit factor on behaviour in this context.

Results indicated significant positive associations between autonomous motivation and attitudes, subjective norm, and perceived behavioural control; and between controlled motivation and subjective norm, indicating that individuals form these belief-based evaluations of reducing pre-drinking alcohol consumption consistent with their motivational orientations. The association between controlled motivation and perceived behavioural control was negative, indicating that individuals who exhibit more external rationales for reducing pre-drinking (e.g., “*because I would feel guilty or embarrassed if I do not*”) likely experience low perceptions of control over engaging in such behaviour in the future. The relationships between autonomous and controlled motivation and perceived behavioural control may be explained by considering perceived behavioural control as comprising *self-efficacy* (e.g., *if I wanted to do X, I could*) and *perceived controllability* (e.g., How much control do you have over doing X?; Armitage & Conner, 1999; Fishbein & Ajzen, 2011)⁹. Similarly, Cooke et al. (2014) demonstrated that self-efficacy and perceived control, components of perceived behavioural control, had different effects on alcohol consumption

⁹Fishbein and Ajzen (2011) refer to these constructs as *capacity* and *autonomy*, respectively.

intentions and behaviour (i.e., self-efficacy was strongly correlated with intentions and behaviour related to engaging in alcohol consumption; whereas perceived control had small negative correlations with intentions and behaviour). The effects of autonomous and controlled motivation on perceived behavioural control may therefore relate to different but related aspects of the superordinate construct. For example, an individual with more controlled motives for reducing pre-drinking alcohol consumption may feel they have low perceived controllability over doing so, as they express external rationales for behavioural engagement. Conversely, an individual who is more autonomously motivated to reduce pre-drinking alcohol consumption may form beliefs consistent with self-efficacy (i.e., “If I wanted to reduce my pre-drinking alcohol consumption, I could”). Future research could further test these relations using distinct measures of perceived controllability and self-efficacy (Cooke et al., 2014).

The finding that autonomous motivation and attitudes predicted intentions to reduce pre-drinking alcohol consumption is consistent with previous research (Cooke et al., 2014; McEachan, Conner, Taylor, & Lawton, 2011). The influence of autonomous motivation on intentions mediated by attitudes suggests individuals believe that reducing pre-drinking alcohol consumption carries meaningful benefits that form the basis of their intentions. However, that intention did not significantly predict behaviour warrants further examination. Given the substantial effect of past behaviour (i.e., baseline pre-drinking alcohol consumption) on follow-up pre-drinking alcohol consumption, the proposed constructs in the integrated behaviour change model had relatively trivial effects on behaviour. This means that even if students held autonomous orientations and positive attitudes toward reducing pre-drinking, such motives were not effective in motivating students’ intentions to reduce their pre-drinking alcohol consumption. It is important to note that the path coefficient between intention and follow-up pre-drinking alcohol consumption, and the zero-order correlation between intention and both past and follow-up behaviour, were not statistically significant and approached-zero. In addition, there was a large effect of past behaviour on follow-up pre-drinking alcohol consumption consistent with previous meta-analytic research on alcohol consumption (Hagger, Chan, Protogerou, & Chatzisarantis, 2016). Together, these findings suggest that pre-drinking behaviour is likely to be, to some extent, habitual, determined by low perceptions of control and the influence of non-conscious processes that arise due to well-learned, automatic associations between contextual and environmental cues and the behaviour (Ouellette & Wood, 1998; Verplanken, Aarts, Knippenberg, & Moonen, 1998).

Given our findings, it appears that pre-drinking is not an overly effortful or reflective process and is, somewhat, influenced by the impulsive system. This is further supported by the statistically significant zero-order correlation between past behaviour and the alcohol identity implicit association test.

Individuals reporting high control over reducing pre-drinking alcohol consumption reported lower levels of pre-drinking alcohol consumption at follow-up. According to Ajzen (1991), this occurs when individuals have a high level of information regarding the behaviour, or when requirements or resources to perform the behaviour remain constant. In this case, individuals high in perceived behavioural control may be better able to access and use available information to form accurate control beliefs regarding reducing pre-drinking alcohol consumption (e.g., the ability to refuse drinks, or plan reductions in advance; Hagger et al., 2012; Murgraff, White, & Phillips, 1996; Young, Connor, Ricciardelli, & Saunders, 2006). The prediction of follow-up pre-drinking alcohol consumption by implicit alcohol identity is consistent with Strack and Deutsch's (2004) proposal that impulsive processes activate previously-learned behavioural schemata – for example, seeing an alcoholic beverage activates the schema for pre-drinking. These processes influence behaviour independent of deliberative processes, such as intentions (Hofmann et al., 2008; Rebar et al., 2016).

It is possible that the relationship between perceived behavioural control and pre-drinking alcohol consumption is reflective of participants' levels of impulsivity, associated with a variety of alcohol consumption behaviours and outcomes (Dick et al., 2010; Henges & Marczinski, 2012). Potentially, individuals with lower levels of control might score highly on explicit measures of impulsivity, such as the Barratt Impulsivity Scale (Barratt, Patton, & Standord, 1975), potentially increasing their susceptibility to the influence of impulsive processes in determining their pre-drinking behaviour. The inclusion of explicit measures of these constructs might be considered in testing models of pre-drinking, to determine their relationship with control and implicit influences related to pre-drinking (Gullo et al., 2010; Houben & Wiers, 2009). Research on evaluative conditioning and the impulsive system includes the use of implicit constructs such as goals (Fishbach, Friedman, & Kruglanski, 2003), as well as attempts to correct and reduce the influence of impulsive processes through various types of training (Allom, Mullan, & Hagger, 2015; Bartsch, Mullan, & Houben, 2014; Black & Mullan, 2015; Houben, Havermans, & Wiers, 2010; Houben, Nederkoorn, Wiers, & Jansen, 2011). Given the results of this study, further research in this area may be

warranted to develop interventions that target both the reflective and impulsive system. Such research should explore the contextual or environmental factors that activate the impulsive processes which influence pre-drinking alcohol consumption, or methods to reduce the susceptibility of individuals to these influences through evaluative conditioning or more explicit attempts to increase control (Hollands, Marteau, & Fletcher, 2016; Houben et al., 2011; Houben & Wiers, 2009; Ouellette & Wood, 1998; Papies, 2016).

Strengths, Limitations, and Future Research Directions

The present study has a number of strengths and limitations that warrant discussion. The application of the comprehensive integrated behaviour change model to an area of research that has tended to lack a theoretical approach, or focus on cognitive processes and mechanisms, represents a substantial contribution to the understanding of pre-drinking behaviour. Although our correlational design does not provide strong evidence of causal links between variables, it highlights important relations between potentially manipulable psychological factors and pre-drinking behaviour that may provide some basic information to inform intervention development. For example, interventions may consider targeting both reflective and impulsive processes - by promoting control over pre-drinking, and reducing the influence of the impulsive system in determining behaviour (Hollands et al., 2016; Papies, 2016).

Of consideration regarding the lack of effect of intention on behaviour is the framing of the intention items in terms of reducing alcohol consumption during pre-drinking sessions (i.e., an approach behaviour; Sheeran, 2002). McEachan et al. (2011) found that “abstinence” behaviours (i.e., avoidance behaviours) were poorly accounted for by the theory of planned behaviour, compared to physical activity or dietary (i.e., approach) behaviours (McEachan et al., 2011). Cooke, Sniehotta, and Schuz (2006), found undergraduates’ intentions not to binge drink (i.e., consuming fewer than 7 or 10 units of alcohol in the next week) were negatively associated with their drinking behaviour at follow-up. Alcohol consumption was not measured in terms of reducing or refraining from pre-drinking in the present study, and studies investigating the influence of the theory of planned behaviour in relation to reductions in alcohol consumption appear relatively scarce (see Cooke et al., 2014). Future studies might investigate the difference in ways of framing the target behaviour in psychological measures (e.g., attitudes), and measuring behaviour as alcohol consumption and reducing alcohol consumption in an experimental design. Doing so would elucidate whether there are different

approach and avoidance pathways to alcohol consumption that could be of benefit to understanding of the relevant processes that lead to behaviour.

Results should also be interpreted in light of the accuracy of participant-reported alcohol consumption (White et al., 2005). Retrospective reports of alcohol consumption are often inaccurate, and tend to be underestimated (Monk, Heim, Qureshi, & Price, 2015). Although we attempted to facilitate participant reporting with a detailed, comprehensive pictorial guide (NHMRC, 2009), we cannot be certain that this increased participants' accuracy. In addition, a lack of correspondence between theory-based measures, and self-reported alcohol consumption may have attenuated the intention-behaviour relationship: the former referred to pre-drinking generally, and the latter to standard drinks consumed when pre-drinking. Future research may attempt to quantify pre-drinking alcohol consumption referred to in measures of psychological constructs to maximise correspondence, as has been done to some extent with binge or heavy episodic drinking studies previously (see Cooke et al., 2014). The context in which the theory of planned behaviour measures are completed should also be considered. Cooke and French (2011) demonstrated that completion location affected the relationship between social cognitive constructs and alcohol consumption. Research is increasingly looking towards measures of blood alcohol concentration and event-level assessment of alcohol consumption using smartphones (e.g., Barry et al., 2013; Kuntsche, Otten, & Labhart, 2015), and these approaches could benefit further research. It should also be noted that the internal consistency of the alcohol identity implicit association test was lower than typically observed (Greenwald et al., 2003), which may be the result of administering the test online. To our knowledge, there is no research that has compared online-administered and laboratory-based implicit association tests. However it is reasonable to assume that a laboratory environment may be preferable for reaction time tasks given the lack of potential 'noise' in the data due to extraneous distractors. However, conducting the present study under laboratory conditions would likely have reduce the sample size and precluded comprehensive analyses of the integrated behaviour change model.

Some discussion of the sample composition and demographic background in relation to study findings is warranted. The majority of the participants were female, studying mainly in health-related disciplines. Evidence for gender differences in relation to pre-drinking alcohol consumption is inconclusive, however may be influenced by context effects such as the absolute number of other pre-drinkers, the number of pre-drinkers from the opposite sex, or the type of alcohol consumed (Hummer, Napper, Ehret, & LaBrie, 2013; Labhart, Wells,

Graham, & Kuntsche, 2014; Ogeil et al., 2016). Differences in alcohol consumption behaviour between faculties of study have been noted, which may reduce the representativeness of the present sample to the university student population (Hallett, Howat, et al., 2014; Webb, Ashton, Kelly, & Kamali, 1997). Finally, the sample on average did not strongly intend to reduce their pre-drinking alcohol consumption, as indicated by the weak relationship between pre-drinking alcohol consumption and intention. Although we have no reason to believe that the low levels of intention and weak intention-behaviour relationship in the current study are not representative of the student population as a whole, it would be premature to reject the integrated model on the basis of these data alone. Replications of current findings in larger, more representative samples is warranted to corroborate current findings.

Conclusion

The present study tested an integrated behaviour change model in a pre-drinking context. Overall, we found little support for many of the relationships between motivational and social cognitive constructs, as well as their effects on pre-drinking alcohol consumption. Only the direct effects from perceived behavioural control and implicit alcohol identity constructs on pre-drinking alcohol consumption at follow-up were significant, after controlling for past behaviour. We suggest that future research test the relationships between motivational regulations, affective components of attitudes, and perceptions of control (i.e., self-efficacy and perceived controllability), and continue to incorporate non-conscious predictors of behaviour. Doing so may provide a better understanding of the psychological constructs that are influential in determining pre-drinking alcohol consumption, which may contribute to the development of behaviour change interventions to reduce pre-drinking behaviour that target both constructs of both the reflective and impulsive systems (e.g., Caudwell, Mullan, & Hagger, 2016).

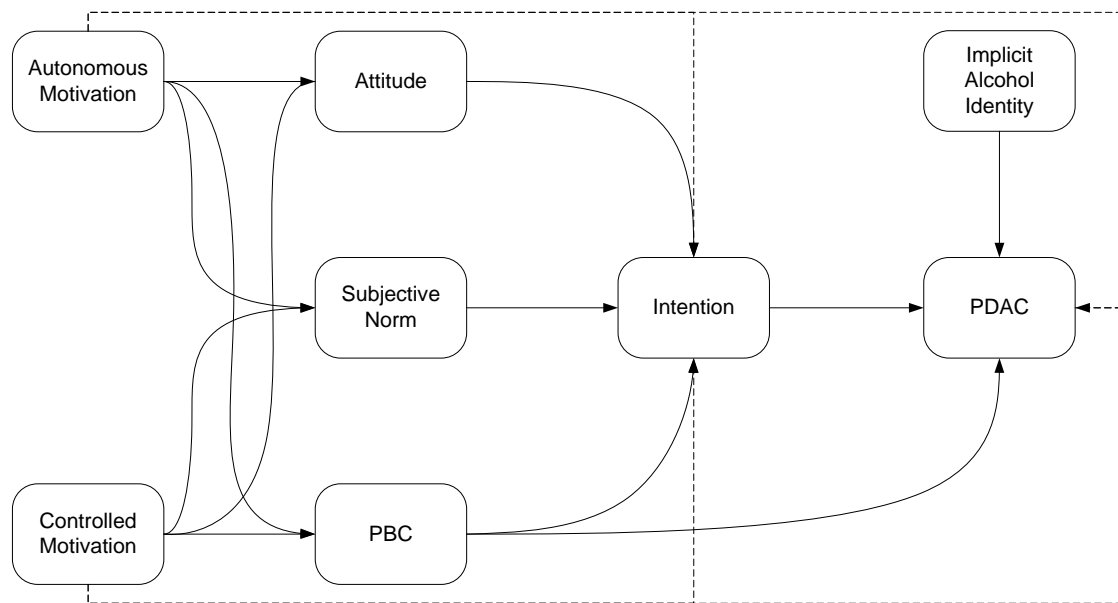


Figure 1. The integrated behaviour change model as applied to pre-drinking alcohol consumption (adapted from Hagger & Chatzisarantis, 2014). Dashed lines represent paths which are posited to be mediated by the hypothesised paths (e.g., autonomous motivation → attitude → intention). Past behaviour (i.e., baseline pre-drinking alcohol consumption) is omitted for clarity.

Note. PBC = perceived behavioural control; PDAC = follow-up pre-drinking alcohol consumption

Table 1. *Descriptive and, Model Evaluation Statistics, and Correlations between Latent Variables from the Integrated Behaviour Change Model*

	1. Source	2. Gender	3. Age	4. PB	5. AM	6. CM	7. Att	8. SN	9. PBC	10. Int	11. D	12. PDAC
<i>M</i>	-	-	20.14	3.46	1.90	1.44	3.68	3.45	5.40	2.78	.29	2.67
<i>SD</i>	-	-	2.33	4.69	.70	.52	1.09	1.09	.64	1.43	.46	6.40
<i>AVE</i>	-	-	-	.60	.64	.50	.60	.75	.58	.96	-	.78
α	-	-	-	.77	.92	.86	.83	.89	.74	.98	-	.91
ρ	-	-	-	.85	.93	.89	.88	.92	.84	.99	-	.94
FCVIF	1.16	1.11	1.05	1.28	1.73	1.55	1.91	1.41	1.22	2.81	1.05	1.23
1.	-											
2.	.02	-										
3.	.08	-.02	-									
4.	-.08	-.10	-.12*	.77								
5.	.10	.03	.10	-.22**	.80							
6.	-.09	-.04	-.01	-.03	.44**	.71						
7.	-.05	.14*	.09	-.09	.46**	.30**	.78					
8.	-.10	-.01	-.02	.08	.26**	.38**	.44**	.87				
9.	.28**	.06	.09	-.13*	.01	-.26**	.04	-.05	.76			
10.	-.04	.14*	.02	-.01	.49**	.37**	.62**	.35**	<.01	.98		
11.	-.12*	-.04	-.08	.05	-.01	.11	.03	.10	-.02	.07	-	
12.	-.12*	-.16	-.10	.34**	-.08	.03	-.05	.02	-.18**	<-.01	.07	.89

Note. $\sqrt{\text{AVE}}$ values are presented on the principal diagonal for variables with multiple indicators.

PB = past behaviour (i.e., baseline pre-drinking alcohol consumption); AM = autonomous motivation; CM = controlled motivation; Att = attitude; SN = subjective norm; PBC = perceived behavioural control; Int = intention; D = AI-IAT D-score; PDAC = follow-up pre-drinking alcohol consumption; α = Cronbach's alpha; ρ = composite reliability. * $p < .05$; ** $p < .01$. For dichotomous variables Source and Gender, 1 = Western Australia/male; 2 = Queensland/female.

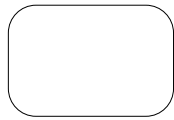


Figure 2. Path diagram showing statistically significant standardised path coefficients (β) between variables in the integrated behaviour change model, with variance explained ($R^2_{Adj.}$) in intention and pre-drinking alcohol consumption.

Note. $*p < .05$ $**p < .01$. PBC = perceived behavioural control; AI-IAT = alcohol identity implicit association test; PDAC = follow-up pre-drinking alcohol consumption. The path from past behaviour to PDAC ($\beta = .36, p < .001, f^2 = .14$) was omitted for clarity. Relationships between control and model variables are included in the online supplementary materials.

References

- Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, 50(2), 179-211. doi:10.1016/0749-5978(91)90020-t
- Ajzen, I. (2002). Constructing a TPB questionnaire: Conceptual and methodological considerations. 1-14.
- Ajzen, I. (2015). The theory of planned behaviour is alive and well, and not ready to retire: a commentary on Sniehotta, Pesseau, and Araújo-Soares. *Health Psychology Review*, 9(2), 131-137. doi:10.1080/17437199.2014.883474
- Allom, V., Mullan, B., & Hagger, M. S. (2015). Does inhibitory control training improve health behaviour? A meta-analysis. *Health Psychology Review* 10(2), 168-186.
- Armitage, C. J., & Conner, M. (1999). The theory of planned behaviour: Assessment of predictive validity and perceived control. *British Journal of Social Psychology*, 38(1), 35-54.
- Barry, A. E., Stellefson, M. L., Piazza-Gardner, A. K., Chaney, B. H., & Dodd, V. (2013). The impact of pregameing on subsequent blood alcohol concentrations: An event-level analysis. *Addictive Behaviors*, 38(8), 2374-2377. doi:10.1016/j.addbeh.2013.03.014
- Bartsch, A., Kothe, E., Allom, V., Mullan, B., & Houben, K. (2016). The effect of non-specific response inhibition training on alcohol consumption: an intervention. *Journal of Addiction Research & Therapy*, 7, 260-260. doi:10.4172/2155-6105.1000260
- Black, N., & Mullan, B. (2015). An intervention to decrease heavy episodic drinking in college students: The effect of executive function training. *Journal of American College Health*, 63(4), 280-284. doi:10.1080/07448481.2014.990969
- Burns, S., Crawford, G., Hallett, J., Jancey, J., Portsmouth, L., Hunt, K., & Longo, J. (2015). Consequences of low risk and hazardous alcohol consumption among university students in Australia and implications for health promotion interventions. *Open Journal of Preventive Medicine*, Vol.05No.01, 13. doi:10.4236/ojpm.2015.51001
- Caudwell, K. M., & Hagger, M. S. (2014). Pre-drinking and alcohol-related harm in undergraduates: the influence of explicit motives and implicit alcohol identity. *Journal of Behavioral Medicine*, 37(6), 1252-1262. doi:10.1007/s10865-014-9573-6
- Caudwell, K. M., & Hagger, M. S. (2015). Predicting alcohol pre-drinking in Australian undergraduate students using an integrated theoretical model. *Applied Psychology: Health and Well-Being*, 7(2), 188-213. doi:10.1111/aphw.12044

- Caudwell, K. M., Mullan, B. A., & Hagger, M. S. (2016). Combining motivational and volitional approaches to reducing excessive alcohol consumption in pre-drinkers: a theory-based intervention protocol. *BMC Public Health*, 16(45), 1-12.
doi:10.1186/s12889-015-2648-7
- Chawla, N., Neighbors, C., Logan, D., Lewis, M. A., & Fossos, N. (2009). Perceived approval of friends and parents as mediators of the relationship between self-determination and drinking. *Journal of Studies on Alcohol and Drugs*, 70(1), 92.
- Cohen, J. E. (1988). *Statistical Power Analysis for the Behavioral Sciences*. Hillsdale, NJ: Lawrence Erlbaum Associates, Inc.
- Conner, M., Sandberg, T., McMillan, B., & Higgins, A. (2006). Role of anticipated regret, intentions and intention stability in adolescent smoking initiation. *British Journal of Health Psychology*, 11(1), 85-101.
- Cooke, R., Dahdah, M., Norman, P., & French, D. P. (2014). How well does the theory of planned behaviour predict alcohol consumption? A systematic review and meta-analysis. *Health Psychology Review* 10(2), 148-167.
- Cooke, R., Sniehotta, F. F., & Schuz, B. (2007). Predicting binge-drinking behaviour using an extended TPB: Examining the impact of anticipated regret and descriptive norms. *Alcohol and Alcoholism*, 42(2), 84-91. doi:10.1093/alcalc/agl115
- Cooke, R., & French, D. P. (2011). The role of context and timeframe in moderating relationships within the theory of planned behaviour. *Psychology & Health*, 26(9), 1225-1240. doi:10.1080/08870446.2011.572260
- Deci, E. L., & Ryan, R. M. (1985). *Intrinsic motivation and self-determination in human behaviour*. New York: Plenum.
- Fishbach, A., Friedman, R. S., & Kruglanski, A. W. (2003). Leading us not into temptation: Momentary allurements elicit overriding goal activation. *Journal of Personality and Social Psychology*, 84(2), 296.
- Fishbein, M., & Ajzen, I. (2011). *Predicting and changing behavior: The reasoned action approach*: Taylor & Francis.
- Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research*, 18(1), 39-50.
- Foster, J. H., & Ferguson, C. (2013). Alcohol 'pre-loading': A review of the literature. *Alcohol and Alcoholism*, 49(2), 213-226. doi:10.1093/alcalc/agt135

- Furtwaengler, N. A., & Visser, R. O. (2013). Lack of international consensus in low-risk drinking guidelines. *Drug and Alcohol Review*, 32(1), 11-18.
- Greenwald, A. G., Nosek, B. A., & Banaji, M. R. (2003). Understanding and using the Implicit Association Test: I. An improved scoring algorithm. *Journal of Personality & Social Psychology*, 85(2), 197-216. doi:10.1037/0022-3514.85.2.197
- Hagger, M. S. (2009). Theoretical integration in health psychology: Unifying ideas and complementary explanations. *British Journal of Health Psychology*, 14(2), 189-194. doi:10.1348/135910708x397034
- Hagger, M. S. (2016). Non-conscious processes and dual-process theories in health psychology. *Health Psychology Review* 10(4), 375-380. doi:10.1080/17437199.2016.1244647
- Hagger, M. S., Chan, D. K., Protogerou, C., & Chatzisarantis, N. L. (2016). Using meta-analytic path analysis to test theoretical predictions in health behavior: An illustration based on meta-analyses of the theory of planned behavior. *Preventive Medicine*, 89, 154-161. doi:10.1016/j.ypmed.2016.05.020
- Hagger, M. S., & Chatzisarantis, N. L. D. (2009). Integrating the theory of planned behaviour and self-determination theory in health behaviour: A meta-analysis. *British Journal of Health Psychology*, 14(2), 275-302. doi:10.1348/135910708x373959
- Hagger, M. S., & Chatzisarantis, N. L. D. (2014). An integrated behavior change model for physical activity. *Exercise and Sport Sciences Reviews*, 42(2), 62-69.
- Hagger, M. S., Lonsdale, A. J., Hein, V., Koka, A., Lintunen, T., Pasi, H., . . . Chatzisarantis, N. L. D. (2011). Predicting alcohol consumption and binge drinking in company employees: An application of planned behaviour and self-determination theories. *British Journal of Health Psychology*, 1-29. doi:10.1111/j.2044-8287.2011.02043.x
- Hagger, M. S., Lonsdale, A. J., Koka, A., Hein, V., Pasi, H., Lintunen, T., & Chatzisarantis, N. L. D. (2012). An intervention to reduce alcohol consumption in undergraduate students using implementation intentions and mental simulations: A cross-national study. *International Journal of Behavioral Medicine*, 19(1), 82-96.
- Hair, J. F., Hult, G. T. M., Ringle, C., & Sarstedt, M. (2013). *A primer on partial least squares structural equation modeling (PLS-SEM)*. California, USA: SAGE Publications.
- Hair, J. F., Ringle, C. M., & Sarstedt, M. (2011). PLS-SEM: Indeed a Silver Bullet. *Journal of Marketing Theory and Practice*, 19(2), 139-152. doi:10.2753/MTP1069-6679190202

- Hallett, J., Howat, P., McManus, A., Meng, R., Maycock, B., & Kypri, K. (2014). Academic and personal problems among Australian university students who drink at hazardous levels: web-based survey. *Health Promotion Journal of Australia*, 24(3), 170-177.
- Hallett, J., McManus, A., Maycock, B. R., Smith, J., & Howat, P. M. (2014). "Excessive Drinking - an inescapable part of university life?" A focus group study of Australian undergraduates. *Open Journal of Preventive Medicine*, 4(7), 14.
doi:10.4236/ojpm.2014.47071
- Hamilton, K., & Hagger, M. S. (2014). The 'health' of health psychology in Australia: Behavioural approaches and interventions. *Australian Psychologist*, 49(2), 63-65.
- Hofmann, W., Friese, M., & Strack, F. (2009). Impulse and self-control from a dual-systems perspective. *Perspectives on Psychological Science*, 4(2), 162-176.
doi:10.1111/j.1745-6924.2009.01116.x
- Hofmann, W., Friese, M., & Wiers, R. W. (2008). Impulsive versus reflective influences on health behavior: a theoretical framework and empirical review. *Health Psychology Review*, 2(2), 111-137. doi:10.1080/17437190802617668
- Hollands, G. J., Marteau, T. M., & Fletcher, P. C. (2016). Non-conscious processes in changing health-related behaviour: a conceptual analysis and framework. *Health Psychology Review*, 10(4), 381-394. doi:10.1080/17437199.2015.1138093
- Houben, K., Havermans, R. C., & Wiers, R. W. (2010). Learning to dislike alcohol: conditioning negative implicit attitudes toward alcohol and its effect on drinking behavior. *Psychopharmacology*, 211(1), 79-86. doi:10.1007/s00213-010-1872-1
- Houben, K., Nederkoorn, C., Wiers, R. W., & Jansen, A. (2011). Resisting temptation: Decreasing alcohol-related affect and drinking behavior by training response inhibition. *Drug and Alcohol Dependence*, 116(1-3), 132-136.
doi:10.1016/j.drugalcdep.2010.12.011
- Houben, K., & Wiers, R. W. (2009). Response inhibition moderates the relationship between implicit associations and drinking behavior. *Alcoholism: Clinical and Experimental Research*, 33(4), 626-633. doi:10.1111/j.1530-0277.2008.00877.x
- Hummer, J. F., Napper, L. E., Ehret, P. E., & LaBrie, J. W. (2013). Event-specific risk and ecological factors associated with prepartying among heavier drinking college students. *Addictive Behaviors*, 38(3), 1620-1628. doi:10.1016/j.addbeh.2012.09.014
- Keatley, D. A., Clarke, D. D., & Hagger, M. S. (2013). The predictive validity of implicit measures of self-determined motivation across health-related behaviours. *British Journal of Health Psychology*, 18(1), 2-17. doi:10.1111/j.2044-8287.2011.02063.x

- Knee, C. R., & Neighbors, C. (2002). Self-determination, perception of peer pressure, and drinking among college students. *Journal of Applied Social Psychology*, 32(3), 522-543. doi:10.1111/j.1559-1816.2002.tb00228.x
- Kock, N. (2011). Using WarpPLS in e-collaboration studies: Mediating effects, control and second order variables, and algorithm choices. *International Journal of e-Collaboration*, 7(3), 1-13. doi:10.4018/jec.2011070101
- Kock, N. (2014). Advanced mediating effects tests, multi-group analyses, and measurement model assessments in PLS-based SEM. *International Journal of e-Collaboration*, 10(1), 1-13.
- Kock, N. (2015). WarpPLS 5.0 User Manual (pp. 55). Texas, USA: ScriptWarp Systems.
- Kuntsche, E., Otten, R., & Labhart, F. (2015). Identifying risky drinking patterns over the course of Saturday evenings: An event-level study. *Psychology of Addictive Behaviors*, 29, 744-752. doi:10.1037/adb0000057
- Kypri, K., Cronin, M., & Wright, C. S. (2005). Do university students drink more hazardingly than their non-student peers? *Addiction*, 100(5), 713-714. doi:10.1111/j.1360-0443.2005.01116.x
- Labhart, F., Wells, S., Graham, K., & Kuntsche, E. (2014). Do individual and situational factors explain the link between predrinking and heavier alcohol consumption? An event-level study of types of beverage consumed and social context. *Alcohol and Alcoholism*, 49(3), 327-335. doi:10.1093/alcalc/agu001
- LaBrie, J. W., Hummer, J., Kenney, S., Lac, A., & Pedersen, E. (2011). Identifying factors that increase the likelihood for alcohol-induced blackouts in the prepartying context. *Substance Use & Misuse*, 46(8), 992-1002. doi:10.3109/10826084.2010.542229
- LaBrie, J. W., Hummer, J. F., Pedersen, E. R., Lac, A., & Chithambo, T. (2012). Measuring college students' motives behind prepartying drinking: Development and validation of the prepartying motivations inventory. *Addictive Behaviors*, 37(8), 962-969. doi:10.1016/j.addbeh.2012.04.003
- Lindgren, K. P., Foster, D. W., Westgate, E. C., & Neighbors, C. (2013). Implicit drinking identity: Drinker + me associations predict college student drinking consistently. *Addictive Behaviors*, 38(5), 2163-2166. doi:10.1016/j.addbeh.2013.01.026
- Lindgren, K. P., Neighbors, C., Teachman, B. A., Baldwin, S. A., Norris, J., Kaysen, D., . . . Wiers, R. W. (2016). Implicit alcohol associations, especially drinking identity, predict drinking over time. *Health Psychology*, 35(8), 908. doi:10.1037/hea0000396

- Lindgren, K. P., Neighbors, C., Teachman, B. A., Wiers, R. W., Westgate, E., & Greenwald, A. G. (2012). I drink therefore I am: Validating alcohol-related implicit association tests. *Psychology of Addictive Behaviors*, 27(1). doi:10.1016/j.addbeh.2013.01.026
- Lindgren, K. P., Ramirez, J. J., Olin, C. C., & Neighbors, C. (2016). Not the same old thing: Establishing the unique contribution of drinking identity as a predictor of alcohol consumption and problems over time. *Psychology of Addictive Behaviors*, 30(6), 659. doi:10.1037/adb0000195
- McEachan, R. R. C., Conner, M., Taylor, N. J., & Lawton, R. J. (2011). Prospective prediction of health-related behaviours with the theory of planned behaviour: A meta-analysis. *Health Psychology Review*, 5(2), 97-144. doi:10.1080/17437199.2010.521684
- McLachlan, S., & Hagger, M. S. (2011). The influence of chronically accessible autonomous and controlling motives on physical activity within an extended theory of planned behavior. *Journal of Applied Social Psychology*, 41(2), 445-470.
- Miller, P. G., Droste, N., Groot, F., Palmer, D., Tindall, J., Busija, L., . . . Wiggers, J. (2015). Correlates and motives of pre-drinking with intoxication and harm around licensed venues in two cities. *Drug and Alcohol Review*, 35(2), 177-186. doi:10.1111/dar.12274
- Monk, R. L., Heim, D., Qureshi, A., & Price, A. (2015). "I have no clue what I drunk last night" Using smartphone technology to compare in-vivo and retrospective self-reports of alcohol consumption. *PloS One*, 10(5), e0126209.
- Murgraff, V., White, D., & Phillips, K. (1996). Moderating binge drinking: It is possible to change behaviour if you plan it in advance. *Alcohol and Alcoholism*, 31(6), 577-582.
- National Health and Medical Research Council. (2009). *Australian guidelines to reduce risks from drinking alcohol*. Canberra, ACT: Commonwealth of Australia.
- Neal, D. J., & Simons, J. S. (2007). Inference in regression models of heavily skewed alcohol use data: A comparison of ordinary least squares, generalized linear models, and bootstrap resampling. *Psychology of Addictive Behaviors*, 21(4), 441. doi:10.1037/0893-164X.21.4.441
- Ogden, J. (2003). Some problems with social cognition models: A pragmatic and conceptual analysis. *Health Psychology*, 22(4), 424-428. doi:10.1037/0278-6133.22.4.424
- Ogeil, R. P., Lloyd, B., Lam, T., Lenton, S., Burns, L., Aiken, A., . . . Lubman, D. I. (2016). Pre-Drinking Behavior of Young Heavy Drinkers. *Substance Use & Misuse*, 51(10), 1297-1306. doi:10.3109/10826084.2016.1168443

- Orbell, S., & Sheeran, P. (1998). 'Inclined abstainers': A problem for predicting health-related behaviour. *British Journal of Social Psychology*, 37(2), 151-165.
doi:10.1111/j.2044-8309.1998.tb01162.x
- Ouellette, J. A., & Wood, W. (1998). Habit and intention in everyday life: The multiple processes by which past behavior predicts future behavior. *Psychological bulletin*, 124(1), 54. doi:10.1037/0033-2909.124.1.54
- Papies, E. K. (2016). Health goal priming as a situated intervention tool: how to benefit from nonconscious motivational routes to health behaviour. *Health Psychology Review*, 10(4), 408-424. doi: 10.1080/17437199.2016.1183506
- Pedersen, E. R., & LaBrie, J. W. (2007). Partying before the party: Examining prepartying behavior among college students. *Journal of American College Health*, 56(3), 237-245. doi:10.3200/JACH.56.3.237-246
- Ramirez, J. J., Dennhardt, A. A., Baldwin, S. A., Murphy, J. G., & Lindgren, K. P. (2016). Alcohol-approach inclinations and drinking identity as predictors of behavioral economic demand for alcohol. *Experimental and Clinical Psychopharmacology*, 24(5). doi:10.1037/pha0000086
- Rebar, A. L., Dimmock, J. A., Jackson, B., Rhodes, R. E., Kates, A., Starling, J., & Vandelanotte, C. (2016). A systematic review of the effects of non-conscious regulatory processes in physical activity. *Health Psychology Review*, 10(4), 395-407. doi:10.1080/17437199.2016.1183505
- Sheeran, P. (2002). Intention-behavior relations: A conceptual and empirical review. *European Review of Social Psychology*, 12(1), 1-36.
doi:10.1080/14792772143000003
- Strack, F., & Deutsch, R. (2004). Reflective and impulsive determinants of social behavior. *Personality and Social Psychology Review*, 8(3), 220-247.
doi:10.1207/s15327957pspr0803_1
- Tenenhaus, M., Amato, S., & Vinzi, V. E. (2004). *A global goodness-of-fit index for PLS structural equation modelling*. Paper presented at the XLII SIS Scientific Meeting, 2004, Padova, Italy. .
- Vansteenkiste, M., Simons, J., Lens, W., Sheldon, K. M., & Deci, E. L. (2004). Motivating learning, performance, and persistence: the synergistic effects of intrinsic goal contents and autonomy-supportive contexts. *Journal of Personality and Social Psychology*, 87(2), 246. doi:10.1037/0022-3514.87.2.246

- Verplanken, B., Aarts, H., Knippenberg, A., & Moonen, A. (1998). Habit versus planned behaviour: A field experiment. *British Journal of Social Psychology*, 37(1), 111-128. doi:10.1111/j.2044-8309.1998.tb01160.x
- Vinzi, V. E., Chin, W. W., Henseler, J., & Wang, H. (2010). *Handbook of Partial Least Squares : Concepts, Methods and Applications*. New York, USA: Springer.
- Webb, E., Ashton, H., Kelly, P., & Kamali, F. (1997). Patterns of alcohol consumption, smoking and illicit drug use in British university students: interfaculty comparisons. *Drug & Alcohol Dependence*, 47(2), 145-153. doi:10.1016/S0376-8716(97)00083-5
- Weinstein, N. D. (2007). Misleading tests of health behavior theories. *Annals of Behavioral Medicine*, 33(1), 1-10.
- Wells, S., Graham, K., & Purcell, J. (2009). Policy implications of the widespread practice of 'pre-drinking' or 'pre-gaming' before going to public drinking establishments - Are current prevention strategies backfiring? *Addiction*, 104(1), 4-9. doi:10.1111/j.1360-0443.2008.02393.x
- White, A. M., Kraus, C. L., Flom, J. D., Kestenbaum, L. A., Mitchell, J. R., Shah, K., & Swartzwelder, H. S. (2005). College students lack of knowledge of standard drink volumes: Implications for definitions of risky drinking based on survey data. *Alcoholism: Clinical and Experimental Research*, 29(4), 631-638. doi:10.1097/01.alc.0000158836.77407.e6
- Willaby, H. W., Costa, D. S. J., Burns, B. D., MacCann, C., & Roberts, R. D. (2015). Testing complex models with small sample sizes: A historical overview and empirical demonstration of what Partial Least Squares (PLS) can offer differential psychology. *Personality and Individual Differences*, 84, 73-78. doi:10.1016/j.paid.2014.09.008
- Young, R. M., Connor, J. P., Ricciardelli, L., & Saunders, J. B. (2006). The role of alcohol expectancy and drinking refusal self-efficacy beliefs in university student drinking. *Alcohol and Alcoholism*, 41(1), 70-75.

Supplementary Table 1. *Correlations Between Control and Model Variables in the Integrated Behaviour Change Model*

	Source	Gender	Age	PB	AM	CM	Att	SN	PBC	Intention	D	PDAC
Source	-	.02	.08	-.08	.10	-.09	-.05	-.10	.28*	-.04	-.12*	-.12*
Gender		-	-.02	-.10	.03	-.04	.14*	-.01	.06	.14*	-.04	-.16**
Age			-	-.12*	.10	-.01	.10	-.02	.10	.02	-.08	-.10

* $p < .05$; ** $p < .01$;

PBSD = past behaviour; AM = autonomous motivation; CM = controlled motivation; Att = attitude; SN = subjective norm; PBC = perceived behavioural control; D = alcohol identity implicit association test score; PDAC = pre-drinking alcohol consumption.

For dichotomous variables Source and Gender, 1 = Western Australia/male; 2 = Queensland/female.

Supplementary Table 2. *Mediation Results for Paths in the Integrated Behaviour Change Model*

Path	Mediator	Direct (f^2)	p	Indirect (f^2)	p	Total (f^2)	p	Mediation
AM-Int	Att			.18 (.09)	<.001	.41 (.21)	<.001	Partial
	SN	.23 (.12)	<.001	.01 (.01)	.388	.24 (.13)	<.001	None
	PBC			<.01 (<.01)	.499	.23 (.12)	<.001	None
CM-Int	Att			.04 (.02)	.162	.16 (.06)	.003	None
	SN	.12 (.05)	.022	.02 (.01)	.320	.14 (.05)	.009	None
	PBC			<.01 (<.01)	.499	.12 (.05)	.022	None
AM-PDAC	Att			.01 (<.01)	.403	⁂-.01 (<.01)	.456	None
	SN			<.01 (<.01)	.495	.02 (<.01)	.396	None
	PBC	⁂-.02 (<.01)	.369	<.01 (<.01)	.499	⁂-.02 (<.01)	.401	None
	Int			.01 (<.01)	.414	⁂-.01 (<.01)	.461	None
CM-PDAC	Att			<.01 (<.01)	.494	⁂-.06 (.01)	.162	None
	SN			⁂-.01 (<.01)	.409	⁂-.07 (.01)	.104	None
	PBC	⁂-.06 (.01)	.153	.04 (.01)	.166	⁂-.02 (<.01)	.370	None
	Int			.01 (<.01)	.440	⁂-.06 (.01)	.163	None
Att-PDAC	Int	⁂-.01 (<.01)	.440	.01 (<.01)	.383	<.01 (<.01)	.476	None
SN-PDAC	Int	⁂-.03 (<.01)	.285	<.01 (<.01)	.482	⁂-.03 (<.01)	.297	None
PBC-PDAC	Int	⁂-.17 (.03)	.002	<.01 (<.01)	.500	⁂-.17 (.03)	.002	None

Note. AM = autonomous motivation; Int = intention; Att = attitude; SN = subjective norm; PBC = perceived behavioural control; CM = controlled motivation; PDAC = follow-up pre-drinking alcohol consumption

**CHAPTER V: COMBINING MOTIVATIONAL AND VOLITIONAL APPROACHES
TO REDUCING EXCESSIVE ALCOHOL CONSUMPTION IN PRE-DRINKERS: A
THEORY-BASED INTERVENTION PROTOCOL**

This chapter includes a published study protocol for an intervention to reduce pre-drinking alcohol consumption in undergraduates, based on formative research, and strategies drawing from multiple theoretical paradigms and associated research findings. The published version of the protocol manuscript is included below. The citation for the manuscript is as follows:

Caudwell, K. M., Mullan, B. A., & Hagger, M. S. (2016). Combining motivational and volitional approaches to reducing excessive alcohol consumption in pre-drinkers: a theory-based intervention protocol. *BMC Public Health*, 16(45), 1-12.
doi:10.1186/s12889-015-2648-7

STUDY PROTOCOL

Open Access



Combining motivational and volitional approaches to reducing excessive alcohol consumption in pre-drinkers: a theory-based intervention protocol

Kim M. Caudwell*, Barbara A. Mullan and Martin S. Hagger

Abstract

Background: Pre-drinking refers to the consumption of alcohol at home or a private residence prior to attending a subsequent social event. We present the study protocol of an online theory-based intervention to reduce pre-drinking and related harm in pre-drinking undergraduates, using behavior change techniques targeting the motivational and volitional phases of behaviour.

Design: A fully randomized 2 (autonomy support: present vs. absent) x 2 (implementation intention: present vs. absent) between-participants design will be used to ascertain the effectiveness of the intervention in reducing pre-drinking alcohol consumption and alcohol-related harm. Participants will complete a range of theory-based measures prior to being allocated to one of the four experimental conditions. Four weeks later, participants will complete a follow-up questionnaire comprised of theoretical and behavioral measures.

Analyses: The main and interactive effects of the intervention components in reducing our primary dependent variables, namely, pre-drinking alcohol consumption and alcohol-related harm at four-week follow-up will be tested. Baseline alcohol consumption and demographic information will be included in the analysis as covariates.

Discussion: This online intervention is the first to be developed to reduce pre-drinking alcohol consumption, a behaviour linked to increased risk of alcohol-related harm. The intervention targets motivational and volitional components of the behaviour change process and is therefore likely to lead to greater reductions in pre-drinking alcohol consumption and experience of alcohol-related harm compared to either approach in isolation. If successful, the intervention can be implemented across various contexts and in populations where pre-drinking is prevalent.

Trial registration: ACTRN12614001102662. Registered 16 October 2014.

Keywords: Pre-drinking, Alcohol consumption, Theory-based intervention, Autonomy support, Implementation intention, Theoretical integration

* Correspondence:
Health Psychology & Behavioural Medicine Research Group, School of
Psychology and Speech Pathology, Curtin University, Perth, Australia

Background

Excessive alcohol consumption is associated with increased risk of acute (e.g., accidental injury) and chronic (e.g., cardiovascular disease, cancers, diabetes, liver disease, alcohol dependence, and a range of mental health conditions) harms [1]. In Australia, national costs of excessive alcohol consumption is estimated at 15 billion dollars annually, attributed to decreased workplace productivity, strain on the healthcare system, road or vehicular accidents, crime and associated costs, illness, and death [2]. Excessive alcohol consumption is especially apparent in university populations, with a third of students drinking to hazardous levels [3, 4] and appearing to outdrink their non-student peers on drinking occasions [5, 6]. Research shows that excessive alcohol consumption significantly impairs students' health and academic performance, and increases risk-taking behaviors such as unplanned sexual activity [7].

Recent research has focussed on *pre-drinking*, the practice of consuming alcohol prior to attending a subsequent event, where alcohol consumption often continues [8, 9]. Pre-drinking is also referred to as *preparty* [8], *pregaming* [9], and *pre-loading* [10]. Pre-drinking has been found to constitute more than 40 % of alcohol consumption on drinking occasions [11], and an Australian multi-site study conducted in night entertainment areas found 65 % of people reported pre-drinking prior to 'going out' for that evening [12]. Pre-drinking has been shown to be largely socially-motivated, with pre-drinkers citing "catching up" with friends and meeting new people as precipitating factors contributing to the popularity of these sessions [13–15]. LaBrie et al. [15] found that *interpersonal enhancement* (i.e., pre-drinking for socialisation or enjoyment) was the strongest predictor of pre-drinking frequency and alcohol consumption, and demonstrated that pre-drinking motives differ from general alcohol consumption motives. Alcohol price has also been shown to be related to pre-drinking. Not only have students cited cost as influencing their pre-drinking [11, 16], but Miller and Droste [17] have shown that students change their hypothetical drinking decisions based on increases in the cost per drink. A recent study shows a relationship between strongly endorsing a cost motive for pre-drinking, and higher reported typical pre-drinking consumption [18].

In a series of recent studies, pre-drinking has been implicated as specifically contributing to alcohol-related harm. An event-level analysis by Barry et al. [19] found pre-drinking status significantly predicted blood-alcohol concentration, as measured by a breathalyser device. Merrill et al., [20] used event-level associations to reveal that pre-drinking on any given day was a significant predictor of alcohol related harm in university students, beyond both the total alcohol consumed on that day, and typical drinks consumed per day. In a sample of

undergraduates, Caudwell and Hagger [18] found higher scores on pre-drinking cost motive items predicted higher incidence of alcohol-related harm in the previous twelve months. Pre-drinking appears to present an elevated risk to young adults, who demonstrate a lack of awareness of safe alcohol consumption limits [21], and, in laboratory settings, are unable to accurately pour a standard drink¹ [22, 23]. To date, no interventions specifically aimed at reducing pre-drinking alcohol consumption have been developed. This protocol outlines a theory-based intervention that will attempt to reduce alcohol consumption during pre-drinking sessions, and the experience of alcohol-related harm.

Theory-based interventions for excessive alcohol consumption

One approach to reducing excessive alcohol consumption and alcohol-related harm among undergraduates is to develop behavioral interventions based on social psychological and motivational theories of health behavior. The use of such theories in informing interventions is important in targeting the influential determinants of health behavior, facilitating an understanding of "what works, and for whom", and allows for testing of the component theories in accounting for behavior change [24]. A range of health behavioral interventions targeting excessive alcohol consumption have been developed in university student populations, incorporating brief screening and feedback [25], motivational [26–28], peer or normative feedback [29–31], planning [32], and volitional approaches [33–35]. Though the efficacy of online interventions appears to bring about small changes in alcohol consumption behaviour [$d = 0.14$; [36]], many interventions are not theory-based, and there is evidence that theory-based interventions that closely develop intervention content to target specific psychological variables (commonly identified as correlates or predictors of alcohol consumption) are efficacious, with medium-sized effects [37, 38]. Furthermore, evidence supports the use of online delivery of alcohol interventions in student populations as they appear preferable to face-to-face methods (e.g., contact with a health professional) and may be especially useful for at-risk populations [39, 40]. Therefore, the development of a theory-based online intervention to reduce pre-drinking alcohol consumption may be a useful endeavour.

The theory of planned behavior

The *theory of planned behaviour* [41] has been extensively applied to predict a range of health behaviours [42–44]. The theory considers behavioural *intention* the focal point of behavioural engagement, where *intention* is formed by belief-based constructs of *attitude*, *subjective norm*, and *perceived behavioral control* [41]. *Attitude*

comprises belief-based evaluations of the behavior of interest; *subjective norm* consists of perceived social influence regarding behavioural engagement, and; *perceived behavioral control* constitutes the individual's ability to perform the behavior. The theory has been widely used across a range of health behavioural contexts, with a recent meta-analysis supporting the tenets of the theory-based model in predicting intention and behavior [44]. More recently, a meta-analysis of the theory applied to alcohol consumption behaviour has found attitudes strongly related to alcohol consumption intentions ($r_+ = .62$), and intentions moderately related to behaviour ($r_+ = .54$) with authors concluding that both attitudes and intentions towards alcohol consumption are worthwhile targets for alcohol consumption behaviour change [45]. Generally, changes in behavioral intention appear to produce small-to-moderate changes in behaviour [46], with theory-based health behavioral interventions informed by the theory of planned behavior demonstrating particular efficacy [$d_+ = 0.36$; [36]], supporting our advocacy of adopting a theoretical approach.

A prominent criticism of the theory is the *intention-behavior gap*: the relative weakness in the link between intention and behaviour [47–50]. This is an important issue for interventions where intention may be the focus, yet it is a weak or modest predictor of behavioural engagement. For example, McEachan, Conner [44] shows the intention-behaviour relationship is weaker for health risk behaviours, such as abstaining from alcohol consumption, compared to health enhancing behaviors such as diet and exercise. A recent meta-analysis investigating the relationships between the theory of planned behaviour constructs applied to alcohol consumption concluded that interventions targeting attitudes and subjective norm may be worthwhile [45]. However, there is little utility in attempting to change intention through its antecedent constructs, where a substantial intention-behaviour gap is unlikely to facilitate meaningful behaviour change. This point and the utility of the theory of planned behaviour in health behavioural research is one of current debate (see [50]), with Schwarzer [51] suggesting that post-intentional (i.e., volitional) constructs that are known to influence behaviour are of importance in interventions based on the theory of planned behaviour. *Implementation intentions* [52] present an approach to “closing” the intention-behavior gap by linking important contextual cues to enacting the intended behaviour in the volitional stage, increasing the likelihood that the behavior is carried out in accordance with one's intentions.

Implementation intentions and volition

According to Gollwitzer [53], individuals who intend to reach an intended goal often fail to do so due to

limitations in their ability to self-regulate behaviour. These limitations may constitute reasons such as failing to get started (e.g., forgetting or failing to act at the opportunity to do so) and getting derailed (e.g., due to attentional or competing factors; Gollwitzer & Sheeran, [54]). For example, a pre-drinking goal intention may be “I intend to reduce my alcohol consumption drinking during pre-drinking sessions”. However, an individual with this intention may not recognise the chance to enact that intention or fail to do so at the critical moment (e.g., where an environment is conducive to excessive alcohol consumption). *Implementation intentions* increase the likelihood that people will attain their intended goals by specifying contextual details of how these goals will be implemented, as well as when, and where [55]. An implementation intention for pre-drinking may therefore be “when I have finished an alcoholic drink at a pre-drinking session, I will then drink a glass of water or soft drink to help reduce my alcohol consumption”. This allows individuals to switch from making conscious, effortful deliberations about enacting behaviour, to responding automatically to critical cues [52], mitigating the effects of self-regulatory limitations on carrying out intended behaviours. A meta-analysis by Gollwitzer and Sheeran [54] shows that there is a considerable effect ($d_+ = .65$) of implementation intentions in facilitating goal attainment over that of simply forming goal intentions. Importantly, implementation intention approaches have been shown to be effective in reducing alcohol consumption in young people including university students [35, 38, 56].

Key features of an implementation intention approach include detailing *how* the intended behaviour will be enacted. In previous studies using this approach, participants either formed their own implementation intentions [38] or chose from a menu of responses to refusing a drink with the option of developing their own plan [35]. These studies and a recent review by Hagger and Luszczynska [57] suggest that implementation intentions may be more successful if they include additional planning components that address certain contingencies in an *if-then* format, such as “*if* I am offered an alcoholic drink, *then* I will politely refuse by saying, ‘No thanks, I have to drive’” [35]. In the context of pre-drinking, there are likely many contextual scenarios where individuals may be at risk of consuming excessive amount of alcohol (e.g., drinking games, coercion or pressure) [9, 58]. Therefore, the formation of multiple implementation intentions to address these scenarios may be especially effective in reducing pre-drinking alcohol consumption. However, compelling individuals to intend to perform certain behaviours and assisting them in doing so may not be as effective if individuals lack the necessary motivational resources to facilitate the formation of these intentions and subsequent behavior.

Self-determination theory

Another theoretical framework that has seen wide application in many health-related fields is *self-determination theory* [59–62]. Self-determination theory places the *quality* of an individuals' motivation as influential in behavioural engagement and persistence. Individuals who exhibit *controlled motivation* to engage in a behaviour tend to do so because of certain external contingencies - monetary incentive or reward, or for self-esteem rationales such as avoiding guilt or blame, or embarrassment [59]. Individuals who exhibit *autonomous motivation* to engage in a behaviour tend to do so because it serves personally-relevant goals or the act is itself intrinsically rewarding [59]. The more autonomously motivated an individual is towards engaging in behaviour, the more likely they will be to perform and persist in performing that behaviour [63, 64]. Recent evidence indicates attitudes and intentions towards engaging in health behaviour are more strongly linked to autonomous motivation rather than controlled motivation [65, 66].

Health behavioural interventions based on self-determination focus on the facilitation of autonomous motivation [60, 67]. This is often achieved by providing *autonomy support* – a supportive context and rationale for the individuals' internalising of behavioural regulation [63]. The provision of autonomy support and facilitation of autonomous motivation have demonstrated validity in engendering positive behavioural change in a wide context of health behavioural settings [62]. Within the context of alcohol consumption, studies involving self-determination theory have found relationships between autonomous forms of motivation and reductions in self-reported alcohol consumption [68], as well as intentions to keep alcohol consumption within limits, and reductions in alcohol units consumed [69]. Pavey and Sparks found that autonomy in relation to perceptions of health risk information and autonomous motivation to engage in health protective behaviours were related to participation in those behaviours [70–72].

Conversely, studies on peer influences in college drinkers have shown individuals who exhibit controlled motivation to drink excessively do so because they tend to appraise situations from a controlled orientation, related to their sense of self-esteem [73]. Therefore, an intervention that provides an autonomy-supportive context for reduced alcohol consumption may prove effective for pre-drinkers who consume alcohol excessively or in contexts where motivation to reduce excessive alcohol consumption may be lacking. Given research demonstrating the importance of autonomy in enhancing receptiveness to health risk information, and indicating intrinsic goals are more likely to be pursued than those where individuals feel compelled to pursue goals [64, 70, 72], individuals may be more autonomously motivated to reduce their pre-drinking alcohol consumption if they generate their own autonomous reasons for pursuing such a goal.

Evidence for combining approaches

A meta-analysis of internet-based health behavioral interventions has found those incorporating more behavior change techniques tended to have larger effects, potentially due to these techniques targeting different components of the behaviour change process [36]. According to the model of action phases proposed by Heckhausen and Gollwitzer [74], a “Rubicon” exists between a deliberative, or *predecisional* phase, and a volitional, or *preactional* phase. The predecisional phase incorporates the feasibility and desirability of a behavioral outcome; the motivational tendency towards enacting that behavior which leads to the formation of a *goal intention* [75]. The preactional phase therefore incorporates how best to meet the behavioral goal – the stage at which individuals may fall short of meeting that goal due to limitations in their ability to self-regulate behavior [75]. It follows, therefore, that interventions targeting both motivation and volitional phases of action may be more effective in evoking behaviour change.

Studies have also shown that intentions are more likely to be carried out if they are formed consistent with autonomous reasons for engaging in the target behavior [76] and when the behavior is consistent with their psychological needs [77]. Evidence shows support for a synergistic relationship between autonomous motivation and the formation of implementation intentions in facilitating goal-directed behaviour. For example, a study on goal *self-concordance* (i.e., the extent to which a goal-directed behaviour is self-determined), found self-concordance significantly predicted progress on a range of participant goals, and that the relationship between goal self-concordance and progress was dependent on whether or not participants formed implementation intentions [78]. Koestner et al. [79] demonstrated that participants who formed autonomy-supportive implementation intentions achieved greater goal progress than those in a neutral condition ($d = .67$). The authors attribute this to the internalisation of goals in a self-concordant manner that reflects heightened personal interest and meaning. In terms of interventions based on this premise, targeting the motivational and volitional phases in tandem show increased efficacy in reducing alcohol consumption [33], promoting exercise behavior [80], reducing saturated fat intake [81], and improving fitness [82] over either approach in isolation.

The present study

The purpose of the present study is to test an online, theory-based intervention to reduce pre-drinking alcohol consumption among undergraduate students who pre-drink. The intervention will test the effects of two theory-based techniques targeting the predecisional and implemental phases of the model of action phases through: (1) facilitating autonomous motivation to

reduce pre-drinking alcohol consumption, and (2) prompting the individual to form context-specific implementation intentions to help bridge the goal intention-behavior gap. Combining these techniques should see greater reductions in pre-drinking alcohol consumption and alcohol-related harm than either approach in isolation. The current research makes an original contribution to knowledge by adopting a factorial design, which permits us to examine the independent and interactive effects of two intervention components related to different processes in the model of action phases. The research builds on previous approaches to promoting autonomous motivation [79] and based on current 'best practice' recommendations for using implementation intentions [57]. It also follows on from research that suggests that incorporating both motivational and implemental phases is optimally effective in changing health behaviour by targeting multiple processes [38, 80, 81].

Methods

Design

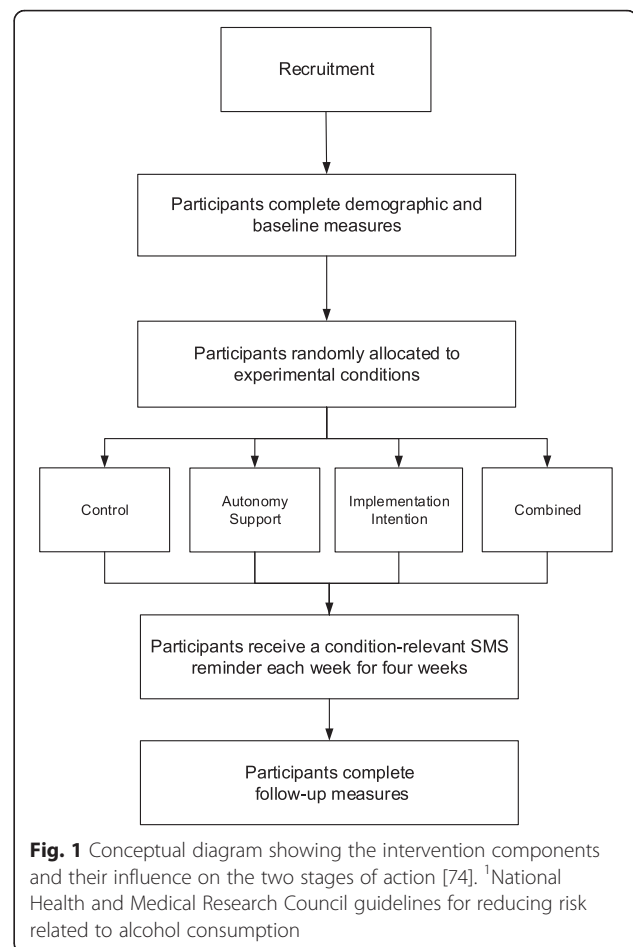
The study will adopt a 2 (autonomy support: present vs. absent) x 2 (implementation intention: present vs. absent) design (see Fig. 1). Given evidence for the use of periodic prompts in supporting online interventions [83, 84] and the increased effectiveness of presenting reminders in implementation intention interventions [85] participants will be sent the components of their respective intervention via email following its conclusion. At follow-up, four weeks later, participants will be invited to complete the same theory-based measures as at baseline to assess the influence of the intervention in terms of changes in theoretical constructs and behavior.

Intervention components

Participants will be randomly allocated to one of four conditions: a control condition, an autonomy support condition, an implementation intention condition, and a combined autonomy support and implementation intention condition. Each condition will include the first two guidelines of the Australian National Health and Medical Research Council safe drinking guidelines [1]. These guidelines are recommendations for keeping alcohol consumption within limits to reduce the risk of alcohol-related harm over the lifetime, and are included in the Appendix. (Fig. 2) shows the intervention components alongside the intended action phase targets.

Autonomy support condition

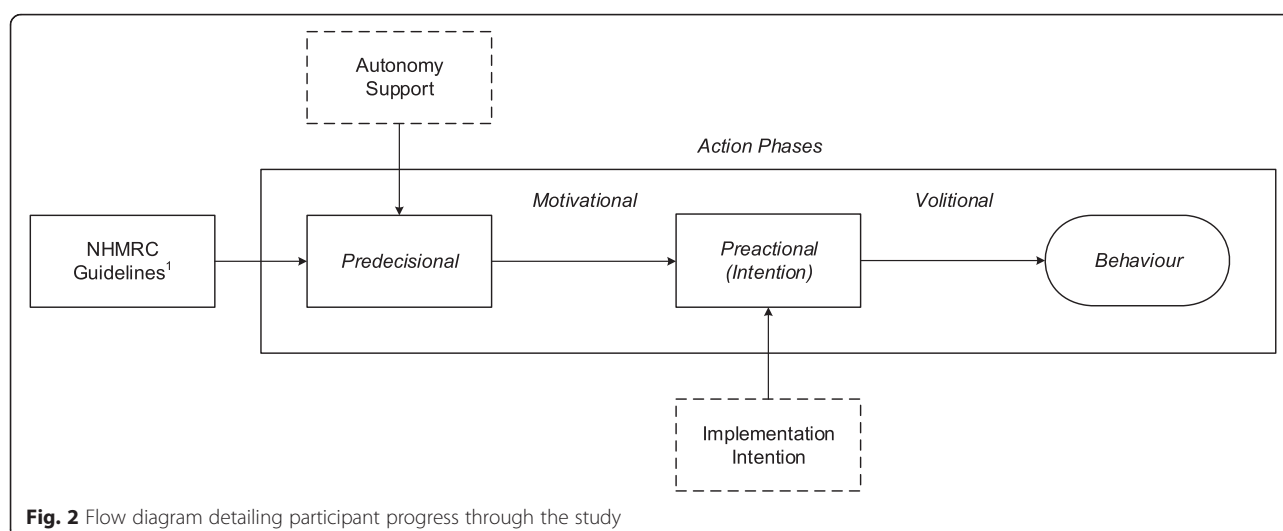
Participants will be asked to generate statements that reflect a series of interpersonal conditions of autonomy support, as outlined in Su and Reeve [86]. These are



closely based on verified approaches used throughout self-determination theory-based interventions to facilitate autonomous motivation to engage in the target behavior [86–89]. The five conditions outlined in Su and Reeve [86] include: providing meaningful rationales (i.e., why self-regulated engagement in reducing pre-drinking alcohol consumption may be beneficial), acknowledging negative feelings (i.e., feelings associated with reducing pre-drinking alcohol consumption); use of non-controlling language (e.g., *may* or *could* rather than *must* or *should*); offering choices (i.e., promoting choice-making and encouragement), and nurturing inner motivational resources (i.e., making the satisfaction of needs for autonomy, competence, and relatedness salient in the communication). Table 1 includes example prompts and statements to be used in the intervention.

Implementation intention condition

Participants will be informed of how forming specific *if-then* plans to reduce their alcohol intake during pre-drinking sessions can assist them in doing so. Given that personally-relevant goals have been found more effective in leading to behavioral engagement [90], and the



importance of self-relevant cues in leading to action, as outlined in Heckhausen and Gollwitzer [74], participants will be asked to detail a series of situations in which they might be at risk of excessive pre-drinking alcohol consumption. Participants will then be provided with examples of implementation intentions before being asked to generate their own that correspond to their identified situations, using two (i.e., *if... then...*) open-response text boxes [57].

Combined condition

Heckhausen and Gollwitzer's [74] action-phase model places the predecisional (i.e., motivational) as preceding a behavioural decision, from which an individual passes through to the preactional (i.e., volitional) phase. Accordingly, participants in the combined condition will first receive the autonomy support component, followed by the implementation intention component. A conceptual map of the intervention components relative to the components in the action-phase model is included in Fig. 2.

Measures

Theory of planned behaviour

Attitude, subjective norm, and perceived behavioural control items will be used based on previous research [38, 91]. *Attitude* will be measured with a common item stem (i.e., *reducing alcohol consumption during pre-drinking sessions would be...*) followed by a series of five bipolar adjectives (e.g., *bad-good*, *beneficial-harmful*), with participants asked to score each adjective accordingly on a six-point scale. *Subjective norm* will be measured with three statements referring to perceived pressure from others to engage in pre-drinking (e.g., *people who are important to me would want me to reduce my alcohol consumption during pre-drinking sessions*) with participants asked to respond to each on

six-point Likert-type scales ranging from 1 (*strongly disagree*) to 6 (*strongly agree*). *Perceived behavioural control* will be measured with three statements regarding control (e.g., *If I wanted to, I could reduce my alcohol consumption during pre-drinking sessions*), with participants asked to respond to each on six-point Likert-type scales ranging from 1 (*strongly disagree*) to 6 (*strongly agree*). *Intention* to reduce pre-drinking alcohol consumption will be measured with three items (e.g., *I will reduce my alcohol consumption during pre-drinking sessions*) with six-point Likert-type scales ranging from 1 (*strongly disagree*) to 6 (*strongly agree*).

Planning

Nine items from the planning subscale of the Self-Regulation Questionnaire [92] will be used to measure participants' planning ability. Participants will respond to these items (e.g., *I have trouble making plans to help me reach my goals*) on six-point Likert-type scales ranging from 1 (*strongly disagree*) to 6 (*strongly agree*).

Autonomous motivation and goal self-concordance

Sheldon and Kasser [77] have developed a measure of goal self-determination, whereby participants rate how much they pursue goals for specific controlled, non-self-determined reasons (e.g., *...because somebody wants me to, or because I'll get something from somebody if I do*, *I probably wouldn't do this if I didn't get some kind of reward, praise, or approval for it*), or autonomous, or self-determined reasons (e.g., *because I really believe that it is an important goal to have – I endorse it freely and value it wholeheartedly*). Participants will respond on nine-point Likert-type scales ranging from 1 (*not at all for this reason*) to 9 (*completely because of this reason*). Controlled scores are subtracted from autonomous scores to derive a relative score for goal self-concordance [76].

Goal progress

Participants will be asked to rate the extent of their progress, if any, in reducing their alcohol consumption during pre-drinking sessions, on a nine-point Likert-type scale ranging from 1 (*none at all*) to 9 (*total progress*), as used in previous research [78].

Pre-drinking alcohol consumption

Participants will report their pre-drinking alcohol consumption in terms of Australian standard drink equivalents consumed during pre-drinking sessions each week, over the previous four weeks, with the aid of a pictorial guide [1], at both baseline and follow-up. The pictorial guide comprises examples of typically served or available portion sizes of alcoholic beverages (e.g., a carton of beer, a bottle of wine or spirits) to aid in participant estimation of pre-drinking alcohol consumption (i.e., pre-purchased quantities such as bottles of spirits or cartons of beer). This approach has been used in previous research [91].

Alcohol-related harm

The Brief Young Adult Alcohol Consequences Scale (B-YAACQ) [93] is a validated measure of the experience of alcohol-related harm that is well-suited to use in college populations for the purpose of evaluating change in alcohol consequences. The measure comprises a series of 24 participant-endorsed yes/no statements related to alcohol-related harm (e.g., “*I have felt very sick to my stomach or thrown up after drinking*”). Scores are derived from summing all yes responses to create a unidimensional index of alcohol-related harm [93]. Participants will complete the B-YAACQ at baseline and follow-up, to ascertain the effects of the intervention in reducing alcohol-related harm attributable to reductions in pre-drinking alcohol consumption. The time-frame of the B-YAACQ will be modified to refer to harm from alcohol consumption in the previous four-week period, to give a fine-grained view of the effects of the intervention on alcohol-related harm (see [94]).

Hypotheses

It is hypothesized that participants receiving both autonomy support and implementation intention components will exhibit greater reductions in pre-drinking alcohol consumption and alcohol-related harm at follow-up, relative to participants receiving either intervention component in isolation, in accordance with evidence supporting the combination of these approaches in potentially targeting two important components of the action-phase model [64, 75, 76].

Participants

Eligible participants will be current undergraduate students who regularly consume alcohol (i.e., are current

‘drinkers’), and have engaged in pre-drinking behaviour within the previous six months. Based on medium effects for implementation intentions on reductions in alcohol consumption reported in Hagger, Lonsdale [33] and the meta-analysis of self-determination theory applied to health contexts reported in Ng et al. [62], we conducted a statistical power analysis using G*Power to ascertain an adequate sample size for the intervention. Specifically, the power analysis was for an Analysis of Covariance (ANCOVA) on the two key dependent variables, alcohol consumption and summed B-YAACQ scores, with the intervention groups as the independent variables powered to detect a medium effect size (Cohen’s $f = .25$) with power set at .80 and alpha set at .025, and baseline scores on the dependent variable as a covariate. The analysis yielded 196 participants (i.e., 49 per group) for each analysis.

Analyses

Randomisation check

A 2 (autonomy support: present or absent) x 2 (implementation intention: present or absent) MANOVA will be conducted, with baseline demographic, behavioural, and psychological measures as dependent variables, and the intervention components as the independent variables, to test for between-group differences across the intervention conditions at baseline.

Manipulation checks

As the effect of implementation intentions might be diminished by participants failing to comply with instructions consistent with the approach, we will content analyse participants’ implementation intention scripts (typed in response to the implementation intention manipulation) to ascertain the extent to which participants complied with the intervention instructions [33]. Independent raters familiar with implementation intentions will rate the quality of scripts based on the presence or absence of key planning components: (1) used the if-then format, (2) specified a relevant, realistic, and appropriate cue, (3) linked the cue to the desired response. A one-way independent groups ANOVA will be conducted to test the effect of autonomy support on goal self-concordance as a manipulation check.

Effects of the intervention on pre-drinking alcohol consumption and alcohol-related harm

Two ANCOVAs (autonomy support: present or absent) x 2 (implementation intention: present or absent) will be conducted to ascertain the effect of the intervention on follow-up self-reported pre-drinking alcohol consumption, and summed B-YAACQ scores, at follow-up, controlling for baseline pre-drinking alcohol consumption.

Effects of the intervention on psychological variables

A 2 (autonomy support: present vs. absent) x 2 (implementation intention: present vs. absent) MANCOVA will be conducted, with autonomous motivation, constructs from the theory of planned behaviour (attitudes, subjective norm, perceived behavioural control, and intention) and goal progress as dependent variables, and pre-intervention pre-drinking alcohol consumption as a covariate.

Ethics

The study protocol was approved by Curtin University Research Ethics Committee (HR185/2014/AR1). Participants will provide informed consent to participate in the intervention.

Discussion

Pre-drinking is associated with significant risks attributable to excessive alcohol consumption [19, 20, 95]. No theory-based interventions to reduce pre-drinking alcohol consumption have yet to be developed. The present protocol has outlined a theory-based intervention that will attempt to reduce pre-drinking alcohol consumption and alcohol-related harm, by targeting the volitional and motivational phases of action, according to the action-phase model outlined by Heckhausen and Gollwitzer [74]. There is evidence that the provision of autonomy support is associated with greater autonomous motivation to engage in behaviour, and that autonomous motivations for reducing alcohol consumption are associated with reductions in alcohol consumption [33, 69]. Although, exhibiting motivation is a necessary but not sufficient condition for behavioural enactment [49, 96]. Forming implementation intentions has been shown to strengthen the link between intention and behaviour, by providing a link between a contextual cue and an intended response [35, 54]. Combining these approaches is based on the premise that promoting goal self-concordance is important in successful goal attainment [78], and is integral to the efficacy of implementation intention approaches [57, 79]. Therefore, an approach that combines the volitional and motivational action phases, providing individuals with autonomy supportive context for behaviour change and the regulatory skills with which to translate this motivational impetus into behaviour, may be more effective in eliciting successful behaviour change. We therefore expect that while participants in the autonomy support and implementation intention conditions will report lower pre-drinking alcohol consumption at follow-up, the combination of these approaches will see the greatest reduction in pre-drinking alcohol consumption. This is because individuals may be autonomously motivated and intend to reduce their pre-drinking alcohol consumption, but may lack the regulatory

capacity required to translate this intention into action (i.e., inclined abstainers) [48]. Similarly, the formation of if-then plans to reduce pre-drinking alcohol consumption may not lead to action if the underlying rationale for these plans is not autonomous [79]. Providing autonomy support to facilitate autonomous motivation will form a sound basis for the development of if-then plans, leading to the translation of that motivational basis into successful action and greater reductions pre-drinking alcohol consumption.

There are some limitations in the design of the intervention that should be noted. As the intervention will be delivered online, there may be potential problems with attrition between baseline and follow-up [33]. This has the potential to reduce the statistical power of the intervention to detect an effect, and limit testing intervention effects on the relevant theoretical constructs. To mitigate this, recruitment will attempt to account for the attrition rate observed in recent online interventions [33, 97]. It is important to note that the primary focus of the intervention is to ascertain the overall efficacy of the intervention conditions in terms of reductions in the primary outcome variables, pre-drinking alcohol consumption and alcohol-related harm, rather than the mediating effects of theoretical constructs which are important issues but secondary to overall effects. Secondly, reviews of alcohol interventions often cite the lack of continued follow-up as detrimental to establishing the efficacy of these interventions over time [40, 98]. However, the efficacy of this intervention can be considered a basis for further research that ascertains the extent of intervention efficacy over time. Finally, there are many issues with the validity and accuracy of self-reported alcohol consumption [99]. However, by using pictorial aids detailing standard drink equivalents for commonly-consumed alcoholic beverage containers [1], we attempt to mitigate errors in measurement. Further, by measuring goal attainment, the effect of the intervention on fulfilling participant goals to reduce pre-drinking alcohol consumption and alcohol-related harm can also be assessed.

Endnotes

¹In Australia, a standard drink is defined as an alcoholic beverage containing 10 g of ethanol (alcohol).

Appendix

Intervention components

Control condition

Participants are presented with two guidelines from the NHMRC [1] to inform them of the relationship between alcohol consumption and the risk of alcohol-related harm over a lifetime, and reducing the risk of injury on a single occasion of drinking.

GUIDELINE 1

Reducing the risk of alcohol-related harm over a lifetime.

The lifetime risk of harm from drinking alcohol increases with the amount consumed.

For healthy men and women, drinking no more than two standard drinks on any day reduces the lifetime risk of harm from alcohol-related disease or injury.

GUIDELINE 2

Reducing the risk of injury on a single occasion of drinking.

On a single occasion of drinking, the risk of alcohol-related injury increases with the amount consumed.

For healthy men and women, drinking no more than four standard drinks on a single occasion reduces the risk of alcohol-related injury arising from that occasion.

Autonomy support condition

Participants are presented with a script comprising a series of statements using autonomy-supportive language, and given prompts to write about reasons pursuing the goal of reducing their pre-drinking alcohol consumption may be worthwhile:

“Over the next few weeks, we’d like you to consider reducing your pre-drinking alcohol consumption. Remember, when we talk about pre-drinking, we mean: drinking alcohol at home, or someone else’s house, prior to attending an event (where drinking alcohol may continue).

Pre-drinking can be harmful, so there are many good reasons why people might set themselves the goal of reducing their pre-drinking alcohol consumption. While we understand that this goal may not be overly enjoyable or interesting, if you identify reasons why reducing your pre-drinking alcohol consumption is important to you, you may feel you are more able to meet this goal. You are free to choose exactly how you will reduce your pre-drinking alcohol consumption – developing your own strategy that uses your set of skills and resources often leads to success.

The following prompts are to help you think of ways you can reduce your pre-drinking alcohol consumption, avoid negative outcomes associated with alcohol consumption, and gain the benefits of reducing pre-drinking alcohol.

You will be taken through these ways step-by-step; as you read, you will be provided with reasons for completing these prompts and how they might help you.

Remember, whether or not you engage in these exercises is entirely up to you - it’s your choice.

Example:

Identifying some of the negative consequences of pre-drinking can be a good first step in forming your plan to reduce your pre-drinking alcohol consumption. Reducing your alcohol consumption during pre-drinking sessions

will help you to avoid some of these negative consequences you may experience when pre-drinking excessively.”

Implementation Intention Condition

Participants are told they are more likely to reach their intended goal of reduced pre-drinking alcohol consumption if they think of “if-then plans” that specify when and where these plans will be enacted:

“You are more likely to carry out your intention to reduce the amount of alcohol you consume during pre-drinking sessions if you make a decision about the time and place you will do so, and how you plan to do it.

Decide now when and where you will need to limit the amount of alcohol you consume during pre-drinking sessions, and how you will do it. We want you to plan to reduce the pre-drinking alcohol you consume over the next month, paying particular attention to the specific situations in which you will need to implement these plans.

For example, you might find it useful to say to yourself: “When I finish an alcoholic beverage during a pre-drinking session, I will then drink a glass of water to help limit my alcohol consumption.”

Alternatively, you might find it useful to say to yourself: “When I am offered a drink during a pre-drinking session, I will say, “No thanks, I have to get up early tomorrow.”

Example:

Please choose from the options below, or write your plans in the text box available, following the format shown in the previous example (i.e., if... then...). Remember, it is important to remember the specific situation in which you need to implement your plan.”

Competing interests

The author(s) declare that they have no competing interests.

Authors’ contributions

KC and MH designed and developed the intervention and analytic plan, and KC drafted the manuscript. BM and MH contributed to the development of the intervention, and commented on subsequent versions of the manuscript. All authors read and approved the final manuscript.

Acknowledgements

None.

Received: 30 April 2015 Accepted: 18 December 2015

Published online: 16 January 2016

References

1. National Health and Medical Research Council. Australian guidelines to reduce risks from drinking alcohol. Canberra, ACT: Commonwealth of Australia; 2009. p. 179.
2. Collins DJ, Lapsley HM. The avoidable costs of alcohol abuse in Australia and the potential benefits of effective policies to reduce the social costs of alcohol. In: Ageing DoHa. Canberra, ACT: Commonwealth of Australia; 2008.
3. Hallett J, Howat P, Maycock B, McManus A, Kypri K, Dhaliwal S. Undergraduate student drinking and related harms at an Australian university: web-based survey of a large random sample. *BMC Public Health*. 2012;12(1):37.
4. Todd J, Mullan B. Using the theory of planned behaviour and prototype willingness model to target binge drinking in female undergraduate university students. *Addict Behav*. 2011;36(10):980–6.

5. Slutske WS. Alcohol use disorders among US college students and their non-college-attending peers. *Arch Gen Psychiatry*. 2005;62(3):321–7.
6. Slutske WS, Hunt-Carter EE, Nabors-Oberg RE, Sher KJ, Bucholz KK, Madden PAF, et al. Do college students drink more than their non-college-attending peers? Evidence from a population-based longitudinal female twin study. *J Abnorm Psychol*. 2004;113(4):530–40.
7. Wechsler H, Nelson TF. What we have learned from the Harvard School of Public Health College Alcohol Study: Focusing attention on college student alcohol consumption and the environmental conditions that promote it. *J Stud Alcohol Drugs*. 2008;69(4):481.
8. Pedersen ER, LaBrie J. Partying before the party: Examining prepartying behavior among college students. *J Am Coll Heal*. 2007;56(3):237–45. PubMed Language: English. Entry Date: 20080314. Revision Date: 20091218. Publication Type: journal article.
9. Borsari B, Boyle KE, Hustad JTP, Barnett NP, O'Leary Tevyaw T, Kahler CW. Drinking before drinking: Pregaming and drinking games in mandated students. *Addict Behav*. 2007;32(11):2694–705.
10. Reed MB, Clapp JD, Weber M, Trim R, Lange J, Shillington AM. Predictors of partying prior to bar attendance and subsequent BrAC. *Addict Behav*. 2011;36(12):1341–3.
11. Read JP, Merrill JE, Bytschkow K. Before the party starts: risk factors and reasons for "pregaming" in college students. *J Am Coll Heal*. 2010;58(5):461–72. PubMed Language: English. Entry Date: 20100507. Revision Date: 20110520. Publication Type: journal article.
12. Miller PG. Patron Offending and Intoxication in Night-Time Entertainment Districts (POINTED). Canberra: National Drug Law Enforcement Research Fund; 2013.
13. Hummer JF, Napper LE, Ehret PE, LaBrie JW. Event-specific risk and ecological factors associated with prepartying among heavier drinking college students. *Addict Behav*. 2013;38(3):1620–8.
14. Paves AP, Pedersen ER, Hummer JF, LaBrie JW. Prevalence, social contexts, and risks for prepartying among ethnically diverse college students. *Addict Behav*. 2012;37(7):803–10.
15. LaBrie JW, Hummer JF, Pedersen ER, Lac A, Chithambo T. Measuring college students' motives behind prepartying drinking: Development and validation of the prepartying motivations inventory. *Addict Behav*. 2012;37(8):962–9.
16. Pedersen ER, LaBrie JW, Kilmer JR. Before you slip into the night, you'll want something to drink: exploring the reasons for prepartying behavior among college student drinkers. *Issues Ment Health Nurs*. 2009;30(6):354–63. PubMed Language: English. Entry Date: 20090814. Revision Date: 20110520. Publication Type: journal article.
17. Miller PG, Droste N. Alcohol price considerations on alcohol and illicit drug use in university students. *J Alcoholism Drug Dependence*. 2013;1(109):2.
18. Caudwell KM, Hagger MS. Pre-drinking and alcohol-related harm in undergraduates: the influence of explicit motives and implicit alcohol identity. *J Behav Med*. 2014;37(6):1252–62.
19. Barry AE, Stellefson ML, Piazza-Gardner AK, Chaney BH, Dodd V. The impact of pregame on subsequent blood alcohol concentrations: An event-level analysis. *Addict Behav*. 2013;38(8):2374–7.
20. Merrill JE, Vermont LN, Bachrach RL, Read JP. Is the pregame to blame? Event-level associations between pregame and alcohol-related consequences. *J Stud Alcohol Drugs*. 2013;74(5):757–64. PubMed PMCID: PMC3749319. Epub 2013/08/21. eng.
21. Livingston M. Perceptions of low-risk drinking levels among Australians during a period of change in the official drinking guidelines. *Drug Alcohol Rev*. 2012;31(2):224–30.
22. White AM, Kraus CL, Flom JD, Kestenbaum LA, Mitchell JR, Shah K, et al. College students lack of knowledge of standard drink volumes: Implications for definitions of risky drinking based on survey data. *Alcohol Clin Exp Res*. 2005;29(4):631–8.
23. De Visser RO, Birch JD. My cup runneth over: Young people's lack of knowledge of low-risk drinking guidelines. *Drug Alcohol Rev*. 2012;31(2):206–12.
24. Michie S. What works and how? Designing more effective interventions needs answers to both questions. *Addiction*. 2008;103(6):886–7. PubMed Language: English. Entry Date: 20080822. Revision Date: 20110701. Publication Type: journal article.
25. Kypri K, Saunders JB, Williams SM, McGee RO, Langley JD, Cashell-Smith ML, et al. Web-based screening and brief intervention for hazardous drinking: a double-blind randomized controlled trial. *Addiction*. 2004;99(11):1410–7.
26. Borsari B, Carey KB. Two brief alcohol interventions for mandated college students. *Psychol Addict Behav*. 2005;19(3):296.
27. Schaaf JF, Sole ML, McCoy TP, Mullett N, O'Brien MC. Alcohol screening and brief intervention in a college student health center: a randomized controlled trial. *J Stud Alcohol Drugs*. 2009;16:131.
28. Kypri K, Hallett J, Howat P, McManus A, Maycock B, Bowe S, et al. Randomized controlled trial of proactive web-based alcohol screening and brief intervention for university students. *Arch Intern Med*. 2009;169(16):1508–14.
29. Walters ST, Vader AM, Harris TR. A controlled trial of web-based feedback for heavy drinking college students. *Prev Sci*. 2007;8(1):83–8. English.
30. Neighbors C, Larimer ME, Lewis MA. Targeting misperceptions of descriptive drinking norms: efficacy of a computer-delivered personalized normative feedback intervention. *J Consult Clin Psychol*. 2004;72(3):434.
31. Lewis MA, Neighbors C, Oster-Aaland L, Kirkeby BS, Larimer ME. Indicated prevention for incoming freshmen: Personalized normative feedback and high-risk drinking. *Addict Behav*. 2007;32(11):2495–508.
32. Black N, Mullan B. An intervention to decrease heavy episodic drinking in college students: The effect of executive function training. *J Am College Health*. 2014 (just-accepted):00-.
33. Hagger MS, Lonsdale A, Chatzisarantis NLD. A theory-based intervention to reduce alcohol drinking in excess of guideline limits among undergraduate students. *Br J Health Psychol*. 2012;17(1):18–43.
34. Armitage CJ. Effectiveness of experimenter-provided and self-generated implementation intentions to reduce alcohol consumption in a sample of the general population: a randomized exploratory trial. *Health Psychol*. 2009;28(5):545.
35. Murgraff V, White D, Phillips K. Moderating binge drinking: It is possible to change behaviour if you plan it in advance. *Alcohol Alcohol*. 1996;31(6):577–82.
36. Webb TL, Joseph J, Yardley L, Michie S. Using the internet to promote health behavior change: A systematic review and meta-analysis of the impact of theoretical basis, use of behavior change techniques, and mode of delivery on efficacy. *J Med Internet Res*. 2010;12(1):e4.
37. Hagger MS, Lonsdale A, Chatzisarantis NLD. Effectiveness of a brief intervention using mental simulations in reducing alcohol consumption in corporate employees. *Psychol Health Med*. 2011;16(4):375–92.
38. Hagger MS, Lonsdale AJ, Koka A, Hein V, Pasi H, Lintunen T, et al. An intervention to reduce alcohol consumption in undergraduate students using implementation intentions and mental simulations: A cross-national study. *Int J Behav Med*. 2012;19(1):82–96.
39. Kypri K, Saunders JB, Gallagher SJ. Acceptability of various brief intervention approaches for hazardous drinking among university students. *Alcohol Alcohol*. 2003;38(6):626–8.
40. White AW, Kavanagh D, Stallman H, Klein B, Kay-Lambkin F, Proudfoot J, et al. Online alcohol interventions: A systematic review. *J Med Internet Res*. 2010;12(5):e62.
41. Ajzen I. The theory of planned behavior. *Organ Behav Hum Decis Process*. 1991;50(2):179–211.
42. Armitage CJ, Conner M. Efficacy of the theory of planned behaviour: A meta-analytic review. *Br J Soc Psychol*. 2001;40:471–99. PubMed PMID: 219214254; 11795063. English.
43. Conner M, Sparks P. Theory of planned behaviour and health behaviour. In: Conner M, Norman P, editors. *Predicting health behaviour*. 2nd ed. Berkshire: McGraw-Hill Education; 2005. p. 170–222.
44. McEachan RRC, Conner M, Taylor NJ, Lawton RJ. Prospective prediction of health-related behaviours with the theory of planned behaviour: A meta-analysis. *Health Psychol Rev*. 2011;5(2):97–144.
45. Cooke R, Dahdah M, Norman P, French DP. How well does the theory of planned behaviour predict alcohol consumption? A systematic review and meta-analysis. *Health psychology review*. 2014 (ahead-of-print):1–20.
46. Webb TL, Sheeran P. Does changing behavioral intentions engender behavior change? A meta-analysis of the experimental evidence. *Psychol Bull*. 2006;132(2):249.
47. Sheeran P. Intention-behavior relations: A conceptual and empirical review. *Eur Rev Soc Psychol*. 2002;12(1):1–36.
48. Orbell S, Sheeran P. 'Inclined abstainers': A problem for predicting health-related behaviour. *Br J Soc Psychol*. 1998;37(2):151–65.
49. Rhodes RE, Bruijn GJ. How big is the physical activity intention-behaviour gap? A meta-analysis using the action control framework. *Br J Health Psychol*. 2013;18(2):296–309.
50. Sniehotta FF, Presseau J, Araujo-Soares V. Time to retire the theory of planned behaviour. *Health Psychology Review*. 2013:1–8.
51. Schwarzer R. Life and death of health behaviour theories. *Health Psychol Rev*. 2013;8(1):53–6.

52. Gollwitzer PM, Brandstätter V. Implementation intentions and effective goal pursuit. *J Pers Soc Psychol*. 1997;73(1):186.
53. Gollwitzer PM. Goal achievement: The role of intentions. *Eur Rev Soc Psychol*. 1993;4(1):141–85.
54. Gollwitzer PM, Sheeran P. Implementation intentions and goal achievement: A meta-analysis of effects and processes. *Adv Exp Soc Psychol*. 2006;38:69–119.
55. Webb TL, Sheeran P. How do implementation intentions promote goal attainment? A test of component processes. *J Exp Soc Psychol*. 2007;43(2):295–302.
56. Murgraff V, Abraham C, McDermott M. Reducing Friday alcohol consumption among moderate, women drinkers: Evaluation of a brief evidence-based intervention. *Alcohol Alcohol*. 2007;42(1):37–41.
57. Hagger MS, Luszczynska A. Implementation intention and action planning interventions in health contexts: State of the research and proposals for the way forward. *Applied Psychology: Health and Well-Being*. 2014;6(1):1–47.
58. Polizzotto MN, Saw MM, Tjhung I, Chua EH, Stockwell TR. Fluid skills: drinking games and alcohol consumption among Australian university students. *Drug Alcohol Rev*. 2007;26(5):469–75.
59. Ryan RM, Connell JP. Perceived locus of causality and internalization: Examining reasons for acting in two domains. *J Pers Soc Psychol*. 1989;57(5):749–61.
60. Deci EL, Ryan RM. Self-determination theory: A macrotheory of human motivation, development, and health. *Can Psychol*. 2008;49(3):182–5.
61. Vallerand RJ, Pelletier LG, Koestner R. Reflections on self-determination theory. *Can Psychol*. 2008;49(3):257–62.
62. Ng JYY, Ntoumanis M, Thøgersen-Ntoumani C, Deci EL, Ryan RM, Duda JL, et al. Self-determination theory applied to health contexts. *Perspect Psychol Sci*. 2012;7(4):325–40.
63. Pelletier LG, Fortier MS, Vallerand RJ, Briere NM. Associations among perceived autonomy support, forms of self-regulation, and persistence: A prospective study. *Motiv Emot*. 2001;25(4):279–306.
64. Vansteenkiste M, Simons J, Lens W, Sheldon KM, Deci EL. Motivating learning, performance, and persistence: the synergistic effects of intrinsic goal contents and autonomy-supportive contexts. *J Pers Soc Psychol*. 2004;87(2):246.
65. Hagger MS, Hardcastle SJ, Chater A, Mallett C, Pal S, Chatzisarantis NLD. Autonomous and controlled motivational regulations for multiple health-related behaviors: between- and within-participants analyses. *Health Psychol Behav Med*. 2014;2:565–601.
66. Caudwell KM, Hagger MS. Predicting alcohol pre-drinking in Australian undergraduate students using an integrated theoretical model. *Applied Psychology: Health and Wellbeing*. in press:1–26.
67. Ryan RM, Patrick H, Deci EL, Williams GC. Facilitating health behaviour change and its maintenance: Interventions based on self-determination theory. *Eur Health Psychol*. 2008;10(1):2–5.
68. Keatley DA, Clarke DD, Hagger MS. The predictive validity of implicit measures of self-determined motivation across health-related behaviours. *Br J Health Psychol*. 2013;18(1):2–17.
69. Hagger MS, Lonsdale AJ, Hein V, Koka A, Lintunen T, Pasi H, et al. Predicting alcohol consumption and binge drinking in company employees: An application of planned behaviour and self-determination theories. *Br J Health Psychol*. 2011;17:1–29.
70. Pavey LJ, Sparks P. Reactance, autonomy and paths to persuasion: Examining perceptions of threats to freedom and informational value. *Motiv Emot*. 2009;33(3):277–90.
71. Pavey LJ, Sparks P. Autonomy and defensiveness: Experimentally increasing adaptive responses to health-risk information via priming and self-affirmation. *Psychol Health*. 2011;27(3):259–76.
72. Pavey LJ, Sparks P. Autonomy and reactions to health-risk information. *Psychol Health*. 2010;25(7):855–72. PubMed Language: English. Entry Date: 20100910. Revision Date: 20110909. Publication Type: journal article.
73. Neighbors C, Larimer ME, Markman Geisner I, Knee CR. Feeling controlled and drinking motives among college students: Contingent self-esteem as a mediator. *Self Identity*. 2004;3(3):207–24.
74. Heckhausen H, Gollwitzer PM. Thought contents and cognitive functioning in motivational versus volitional states of mind. *Motiv Emot*. 1987;11(2):101–20. English.
75. Achtziger A, Gollwitzer PM. Motivation and volition in the course of action. In: Heckhausen J, Heckhausen H, editors. *Motivation and Action*. Cambridge: Cambridge University Press; 2008. p. 272–95.
76. Sheldon KM, Elliot AJ. Not all personal goals are personal: Comparing autonomous and controlled reasons for goals as predictors of effort and attainment. *Pers Soc Psychol*. 1998;24(5):546.
77. Sheldon KM, Kasser T. Pursuing personal goals: Skills enable progress, but not all progress is beneficial. *Personal Soc Psychol Bull*. 1998;24(12):1319–31.
78. Koestner R, Lekes N, Powers TA, Chicoine E. Attaining personal goals: Self-concordance plus implementation intentions equals success. *J Pers Soc Psychol*. 2002;83(1):231–44.
79. Koestner R, Horberg E, Gaudreau P, Powers T, Di Dio P, Bryan C, et al. Bolstering implementation plans for the long haul: The benefits of simultaneously boosting self-concordance or self-efficacy. *Personal Soc Psychol Bull*. 2006;32(11):1547–58.
80. Milne S, Orbell S, Sheeran P. Combining motivational and volitional interventions to promote exercise participation: Protection motivation theory and implementation intentions. *Br J Health Psychol*. 2002;7(2):163–84.
81. Prestwich A, Ayres K, Lawton R. Crossing two types of implementation intentions with a protection motivation intervention for the reduction of saturated fat intake: A randomized trial. *Soc Sci Med*. 2008;67(10):1550–8.
82. Prestwich A, Lawton R, Conner M. The use of implementation intentions and the decision balance sheet in promoting exercise behaviour. *Psychol Health*. 2003;18(6):707–21.
83. Fry JP, Neff RA. Periodic prompts and reminders in health promotion and health behavior interventions: systematic review. *J Med Internet Res*. 2009;11(2):e16. PubMed PMCID: Pmc2762806. Epub 2009/07/28. eng.
84. Sainsbury K, Mullan B, Sharpe L. A randomized controlled trial of an online intervention to improve gluten-free diet adherence in celiac disease. *Am J Gastroenterol*. 2013;108(5):811–7.
85. Sniehotta FF, Scholz U, Schwarzer R, Fuhrmann B, Kiwus U, Völler H. Long-term effects of two psychological interventions on physical exercise and self-regulation following coronary rehabilitation. *Int J Behav Med*. 2005;12(4):244–55.
86. Su Y-I, Reeve J. A meta-analysis of the effectiveness of intervention programs designed to support autonomy. *Educ Psychol Rev*. 2011;23(1):159–88. PubMed PMCID: Pmc2762806. English.
87. Cheon SH, Reeve J, Moon IS. Experimentally based, longitudinally designed, teacher-focused intervention to help physical education teachers be more autonomy supportive toward their students. *J Sport Exerc Psychol*. 2012;34(3):365–96.
88. Cheon SH, Reeve J. Do the benefits from autonomy-supportive PE teacher training programs endure? A one-year follow-up investigation. *Psychol Sport Exer*. 2013;14(4):508–18.
89. Hagger MS, Chatzisarantis NLD. The trans-contextual model of autonomous motivation in education: Conceptual and empirical issues and meta-analysis. *Rev Educ Res*. 2015. Available at: <http://rer.sagepub.com/content/early/2015/05/13/0034654315585005.abstract>
90. Adriaanse MA, de Ridder DTD, de Wit JBF. Finding the critical cue: Implementation intentions to change one's diet work best when tailored to personally relevant reasons for unhealthy eating. *Personal Soc Psychol Bull*. 2009;35(1):60–71.
91. Caudwell KM and Hagger MS. Predicting alcohol pre-drinking in Australian undergraduate students using an integrated theoretical model. *Applied Psychol: Health and Well-Being*. 2015;7(2):188–213.
92. Brown JM, Miller WR, Lawendowski LA. The self-regulation questionnaire. 1999.
93. Kahler CW, Hustad J, Barnett NP, Strong DR, Borsari B. Validation of the 30-day version of the Brief Young Adult Alcohol Consequences Questionnaire for use in longitudinal studies. *J Stud Alcohol Drugs*. 2008;69(4):611–5. PubMed PMCID: PMC2493538. Epub 2008/07/10. eng.
94. Kuntsche E, Labhart F. Drinking motives moderate the impact of pre-drinking on heavy drinking on a given evening and related adverse consequences—an event-level study. *Addiction*. 2013;108(10):1747–55.
95. Labhart F, Graham K, Wells S, Kuntsche E. Drinking before going to licensed premises: An event-level analysis of predrinking, alcohol consumption, and adverse outcomes. *Alcohol Clin Exp Res*. 2013;37(2):284–91.
96. Orbell S, Sheeran P. Motivational and volitional processes in action initiation: A field study of the role of implementation intentions. *J Appl Soc Psychol*. 2000;30:780–97.
97. Postel MG, de Haan HA, Ter Huurne ED, Becker ES, de Jong CA. Effectiveness of a web-based intervention for problem drinkers and reasons for dropout: randomized controlled trial. *J Med Internet Res*. 2010;12(4):e68.

98. Carey KB, Scott-Sheldon LAJ, Carey MP, DeMartini KS. Individual-level interventions to reduce college student drinking: A meta-analytic review. *Addict Behav.* 2007;32(11):2469–94.
99. Del Boca FK, Darkes J. The validity of self-reports of alcohol consumption: State of the science and challenges for research. *Addiction.* 2003;98:1–12.

Submit your next manuscript to BioMed Central and we will help you at every step:

- We accept pre-submission inquiries
- Our selector tool helps you to find the most relevant journal
- We provide round the clock customer support
- Convenient online submission
- Thorough peer review
- Inclusion in PubMed and all major indexing services
- Maximum visibility for your research

Submit your manuscript at
www.biomedcentral.com/submit



**CHAPTER VI: TESTING AN ONLINE, THEORY-BASED INTERVENTION TO
REDUCE PRE-DRINKING ALCOHOL CONSUMPTION AND ALCOHOL-
RELATED HARM IN UNDERGRADUATES: A RANDOMISED CONTROLLED
TRIAL**

This chapter includes a manuscript detailing the outcome of a theory-based, online intervention to reduce undergraduate pre-drinking alcohol consumption and alcohol-related harm. The manuscript is presented as a chapter in its submitted format.

Testing an online, theory-based intervention to reduce pre-drinking alcohol consumption and alcohol-related harm in undergraduates: A randomised controlled trial

Kim M. Caudwell, Barbara A. Mullan, Martin S. Hagger

Health Psychology and Behavioural Medicine Research Group, School of Psychology and Speech Pathology, Faculty of Health Sciences, Curtin University, Perth, Western Australia

Abstract

The present study tested the efficacy of a theory-based online intervention comprising motivational (autonomy support) and volitional (implementation intention) components to reduce pre-drinking alcohol consumption and alcohol-related harm. Undergraduate students (N=202) completed theory-based measures and self-reported pre-drinking alcohol consumption and alcohol-related harm at baseline, were subsequently randomly assigned to one of four conditions in a 2 (autonomy support: present/absent) x 2 (implementation intention: present/absent) design, with a control group. Participants in each condition received national guidelines on alcohol consumption to limit the risk of harm during the intervention, received an email summary of the intervention content at its conclusion, and were sent one condition-relevant SMS message per week over the next four weeks. No statistically significant three-way interaction of autonomy support, implementation intentions, and time on pre-drinking alcohol consumption or alcohol-related harm. Similarly, there was no statistically significant two-way interaction effects of condition and time on pre-drinking alcohol consumption and alcohol-related harm. A statistically significant main effect for time was observed, with reductions in pre-drinking alcohol consumption and alcohol-related harm observed across experimental conditions. Elements common to each condition may have been sufficient to change pre-drinking behaviour.

Keywords: alcohol consumption; pre-drinking; alcohol-related harm; self-determination theory; autonomy support; action phase model; implementation intention

Introduction

Pre-drinking refers to the practice of consuming alcohol prior to attending an event, where alcohol consumption often continues (Pedersen & LaBrie, 2007; Reed et al., 2011; Wells, Graham, & Purcell, 2009). Pre-drinkers consume more alcohol, and are more likely to experience alcohol-related harm, relative to those who do not pre-drink (Barry, Stellefson, Piazza-Gardner, Chaney, & Dodd, 2013; Labhart, Graham, Wells, & Kuntsche, 2013). Pre-drinking is common in university and college populations, where students tend to consume alcohol at hazardous levels, and consider excessive alcohol consumption as integral to the ‘university experience’ (Burns et al., 2015; Hallett, McManus, Maycock, Smith, & Howat, 2014; Karam, Kypri, & Salamoun, 2007; Kypri, Cronin, & Wright, 2005; Slutske et al., 2004). Students tend to engage in pre-drinking in an attempt to reduce the cost of alcohol and to maximize intoxication (Burns et al., 2015; Miller & Droste, 2013). Accordingly, targeted interventions need to be developed to reduce the risk of harm associated with pre-drinking (Pedersen, 2016). Several alcohol interventions have been developed to reduce excessive alcohol consumption behaviours among university and college students (Larimer & Cronce, 2007; Scott-Sheldon, Carey, Elliott, Garey, & Carey, 2014). Many of these interventions draw from psychological theories of social cognition and motivation that include constructs known to influence alcohol consumption (Hagger, Lonsdale, & Chatzisarantis, 2012; Hagger, Lonsdale, Koka, et al., 2012; Neighbors, Larimer, & Lewis, 2004). Such interventions work by attempting to target these motivational and social cognitive constructs in an attempt to elicit concomitant behaviour change (Mullan, Todd, Chatzisarantis, & Hagger, 2014).

Motivational Approaches to Behaviour Change

Two theories that have been applied to alcohol consumption, and received considerable attention in the literature on health behaviour change, are self-determination theory (Deci & Ryan, 1985) and the theory of planned behaviour (Ajzen, 1991). Self-determination theory is an organismic theory of motivation, which makes the distinction between different forms of motivation. Specifically, motivation is proposed to exist on a continuum ranging from *controlled* to *autonomous*. *Controlled motivation* refers to engaging in a behaviour for mostly extrinsic or externally regulated reasons that are not entirely self-determined. For example, an individual may wish to reduce their alcohol consumption because others will be disappointed with them if they do not, or because the individual will feel embarrassed if they fail to do so. Conversely, *autonomous motivation* reflects engaging in behaviour for intrinsic or personally-relevant reasons. For example, an individual might

reduce their alcohol consumption because it carries personally-endorsed benefits (e.g., to health and wellbeing). In contrast to SDT, the theory of planned behaviour (Ajzen, 1991) is a social cognitive theory that posits *intentions* as the most proximal antecedent of behaviour. Intentions are motivational in nature and reflect an individual's assessment of how much effort they are prepared to invest in pursuing the behaviour. Intentions are a function of three sets of belief-based variables: *attitude* (i.e., the individual's positive or negative evaluation of behaviour engagement), *subjective norm* (perceived social influence surrounding behavioural engagement), and *perceived behavioural control* (i.e., control over behavioural engagement). These three sets of beliefs influence behaviour indirectly via the mediation of intention. Perceived behavioural control is also conceptualized as predicting behaviour directly, in instances where an individual's perceptions of control over the behaviour match reality. Self-determination theory and the theory of planned behaviour have been integrated to form a comprehensive account of how individuals' motivational orientations lead them to form consistent belief-based evaluations, and intentions to engage in behaviour (Hagger & Chatzisarantis, 2009). For example, an individual might be motivated to reduce their pre-drinking alcohol consumption because it carries meaningful benefits, which leads them to align their attitudes to be consistent with their motives and hold positive attitudes toward making such reductions in the future, which influences their intentions and subsequent behaviour.

Volitional Approaches to Behaviour Change

The theory of planned behaviour has been widely applied to health behaviours, including alcohol consumption behaviours, and has formed the basis for alcohol consumption interventions (Cooke, Dahdah, Norman, & French, 2014; Murgraff, Abraham, & McDermott, 2007; Webb, Joseph, Yardley, & Michie, 2010). However, Ajzen's (1991) original conceptualization of the theory did not explicitly propose techniques to change these social cognitions, nor the basis for forming these beliefs which may be important targets for intervention (Hagger & Chatzisarantis, 2009; Hardeman et al., 2002). Within self-determination theory, autonomous motivation is facilitated by fulfilment of psychological needs, allowing the reasons for behavioural engagement to become internalized and more self-determined (Deci & Ryan, 2000). Providing an individual with autonomy support fulfils the need for autonomy and fosters autonomous motivation, with experimental research showing that priming the concept of autonomy increases an individual's receptiveness to behaviour change (Pavey & Sparks, 2010, 2011; Su & Reeve, 2011). However, even with

attempts to facilitate autonomous motivation and intentions to change behaviour, individuals do not always behave in accordance with these and are termed *inclined abstainers* (Orbell & Sheeran, 1998). The discrepancy between intentions and behaviour may depend in part on factors such as the individual's level of self-control, or ability to plan (Mullan, Wong, Allom, & Pack, 2011; Sniehotta, Scholz, & Schwarzer, 2005), leading researchers to suggest that intention is a necessary, yet not sufficient, requirement for behaviour change (Hagger et al., 2016). Gollwitzer and Brandstätter (1997) proposed *implementation intentions* as a way to overcome limitations in self-regulation that impede enacting intentions. According to Gollwitzer (1999), simply forming an intention (e.g., "I intend to do X") is not sufficient to enact the concomitant behaviour. An implementation intention augments intentions to include an if-then scenario which passes the cue to prompt the intended action to the environment (e.g., "If I encounter situation X, I will perform response Y to achieve goal Z").

Implementation intentions have been successful in facilitating health behaviour change in a range of contexts, and given environmental influences that relate to alcohol consumption (e.g., being offered an alcoholic beverage at a party), may have particular relevance for reducing pre-drinking excessive alcohol consumption (Armitage, 2009; Hagger, Lonsdale, & Chatzisarantis, 2012; Hagger, Lonsdale, Koka, et al., 2012; Murgraff et al., 2007; Murgraff, White, & Phillips, 1996).

Dual-phase approaches are at the forefront of theoretical research aimed at understanding the processes that underpin health behaviour. Heckhausen (1991) proposed a model of *action phases* that distinguish between motivational and volitional states in the behavioural process. The motivational phase includes constructs leading up to and including *intention* (e.g., autonomous motivation, belief-based evaluations such as attitudes), preceding a volitional stage where that intention may or may not lead to concomitant behaviour. Therefore, the generating of implementation intentions may facilitate the attainment of intended behaviours in the volitional stage by specifying important cue-based responses that are consistent with the target behaviour (e.g., reductions in pre-drinking alcohol consumption). Research from a self-determination theory perspective has demonstrated that implementation intentions appear more effective when an individual's reasons for forming them are more autonomously motivated (Koestner et al., 2006; Koestner, Lekes, Powers, & Chicoine, 2002). Individuals who show high self-regulation – the ability to exert control over behaviour – tend to exhibit autonomous motivation, likely because the enactment of the intended behaviour brings about a personally meaningful or relevant outcome, as opposed to

behaviours that are enacted due to external contingencies (Pelletier, Fortier, Vallerand, & Briere, 2001). Drawing from these theoretical perspectives, targeting the motivational and volitional phases of behaviour through the facilitation of autonomous motivation and the formation of consistent implementation intentions may lead individuals to reduce their pre-drinking alcohol consumption, than either approach in isolation.

The Present Study

Given the importance of motivational and volitional factors in behaviour change consistent with dual-phase models (e.g., Heckhausen, 1991), interventions that include components that target motivation and planning are likely to maximize behavioural engagement, and may be appropriate for individuals with low intentions, or who lack the self-regulatory capacity to enact these intentions. In the present study we aimed to test an intervention that targets both motivational and volitional phases. To target the motivational phase, we provided participants with an autonomy supportive exercise within which they were instructed to reflect on reducing pre-drinking alcohol consumption in terms of key concepts related to autonomy that would facilitate autonomous motivation (Su & Reeve, 2011). To target the volitional stage, we informed participants that goals were more likely attained when individuals form 'if-then' plans to enact these goals, and instructed participants to form implementation intentions following recent best practice recommendations in the literature (Hagger et al., 2016). The intervention was delivered online, as this was considered a preferable medium for university students engaging in health behavioural interventions, could be implemented with high reach at low cost, and was likely to benefit at-risk populations who may not seek health services in relation to their alcohol consumption (Kypri, Saunders, & Gallagher, 2003; Webb et al., 2010; White et al., 2010).

Based on previous research which found that individuals were more likely to adhere to implementation intentions when they are autonomously motivated to perform the target behaviour (Koestner et al., 2006), we hypothesized that participants receiving both the autonomy support and implementation intention intervention components would experience greater reductions in pre-drinking alcohol consumption than participants receiving either of the components alone, and participants receiving the content of a control condition (H_1). We hypothesized main effects for the autonomy support-only (H_2), and implementation intention-only conditions (H_3), in reducing pre-drinking alcohol consumption and alcohol-related harm, relative to a control condition.

Methods

Design and Procedure

The study used a 2 (autonomy support: present vs. absent) x 2 (implementation intention: present vs. absent) randomized controlled design, with students completing a questionnaire and receiving the intervention at baseline, and a follow-up questionnaire, four weeks later. Students were directed to the online study as displayed through Qualtrics™, which comprised an information sheet detailing the study and an instruction to click ‘next’ if they consented to participate, or otherwise close their browser window. Participants completed baseline measures of alcohol consumption and alcohol-related harm, as well as theory-based measures, before being randomly assigned to an experimental condition through use of a Qualtrics™ randomisation tool that assigned a condition number at random to each participant, then proceeded to display elements relevant to that condition based on the number (1 = control; 2 = autonomy support-only; 3 = implementation intention-only; 4 = combined). The study was approved by the university [omitted for blind review] Ethics Committee (Approval Number [omitted for blind review] and pre-registered with the [omitted for blind review] registry. An *a priori* power analysis indicated that to detect a medium effect of the intervention, a sample size of 196 was needed.

Participants in all conditions were initially shown the Australian National Health and Medical Research Council (NHMRC) guidelines on alcohol consumption to reduce the per-occasion and lifetime risk of harm (NHMRC, 2009). Participants assigned to the intervention conditions were then presented with the autonomy support intervention content (i.e., the autonomy support-only) or the implementation intention intervention content (i.e., the implementation intention-only), or both the autonomy support and implementation intention components (i.e., the combined condition). Participants assigned to the control condition received the NHMRC guidelines only at baseline. The content of the autonomy support condition consisted of an exercise in which the participant was instructed to respond to five autonomy-supportive text prompts, presented one at a time, on successive pages (e.g., “Identifying some of the negative consequences of pre-drinking can be a good first step in forming your plan to reduce your pre-drinking alcohol consumption. Reducing your pre-drinking alcohol consumption will help you to avoid some of these negative consequences you may experience when pre-drinking excessively”). These prompts were developed following guidelines regarding autonomy-supportive communication (Su & Reeve, 2011). The content of the implementation intention condition provided participants with a general

definition of an implementation intention, and an example specific to reducing pre-drinking alcohol consumption (e.g., “If I finish an alcoholic beverage during a pre-drinking session, I will then drink a glass of water to help reduce my pre-drinking alcohol consumption”). Participants were then asked either to select implementation intentions from the examples provided, or form their own implementation intentions following the *if-then* format, or both. Participants in the combined condition completed the autonomy support component, followed by the implementation intention component, according to their order in terms of action phases (Heckhausen, 1991).

An automated e-mail was sent to all participants upon completion of the intervention, thanking them for their participation, restating the NHMRC guidelines, a summary of the participant’s responses, if applicable (i.e., their statements from the autonomy support exercise, and/or their implementation intentions), and a reminder to monitor their email inbox for the invitation to complete the follow-up questionnaire in four weeks’ time. Prior to follow-up, participants were sent an automated SMS message relevant to their condition each week over four weeks (i.e., participants assigned to the control group received restated NHMRC guidelines, participants assigned to the autonomy-support, implementation-only, and combined conditions, received SMS messages related to the respective content received), consistent with previous research (Fry & Neff, 2009)¹⁰. At follow-up, participants completed the same measures of pre-drinking alcohol consumption and alcohol-related harm, the theory-based measures, and a measure of goal progress.

Participants

Participants were undergraduate students recruited via posters placed in prominent places around university campuses, through Facebook, and using a university participant pool. Participants were eligible if they were over 18 years of age, and had engaged in pre-drinking (defined as “the practice of consuming alcohol prior to attending a subsequent social event, where alcohol consumption often continues”) within the previous 12 months. Figure 1 shows the progression of participants through the intervention from baseline to follow-up. Thirteen participants did not complete the intervention, leaving a sample of 202 participants ($M_{\text{age}} = 20.95$ years; $SD_{\text{age}} = 4.02$ years; 147 [72.77%] female), of which 54 participants were assigned to the control condition (13 male, $M_{\text{age}} = 20.69$ years; $SD_{\text{age}} = 2.10$ years; 41 female,

¹⁰ The reader is directed to the published protocol of this study (i.e., Chapter VI), where the SMS messages are provided.

$M_{\text{age}} = 20.29$ years, $SD_{\text{age}} = 4.58$ years); 49 to the autonomy support-only condition (14 male, $M_{\text{age}} = 21.86$ years, $SD_{\text{age}} = 2.85$ years; 35 female, $M_{\text{age}} = 21.97$, $SD_{\text{age}} = 5.22$ years); 49 to the implementation intention-only condition (11 male, $M_{\text{age}} = 23.73$ years, $SD = 6.03$ years; 38 female, $M_{\text{age}} = 20.34$ years, $SD_{\text{age}} = 3.78$ years); and 50 to the combined condition (17 male, $M_{\text{age}} = 20.71$, $SD_{\text{age}} = 1.83$; 33 female, $M_{\text{age}} = 20.27$ years, $SD_{\text{age}} = 2.49$ years). A total of 118 (58.42%) participants completed the four week follow-up questionnaire ($M_{\text{age}} = 20.86$ years; $SD_{\text{age}} = 3.87$ years; 87 [73.73%] female). Of these, 30 participants were in the control condition (10 male, $M_{\text{age}} = 20.40$ years; $SD_{\text{age}} = 2.01$ years; 20 female, $M_{\text{age}} = 20.50$ years, $SD_{\text{age}} = 4.82$ years); 32 in the autonomy support-only condition (9 male, $M_{\text{age}} = 21.44$ years, $SD_{\text{age}} = 2.35$ years; 23 female, $M_{\text{age}} = 22.00$ years, $SD_{\text{age}} = 4.86$ years); 31 in the implementation intention-only condition (7 male, $M_{\text{age}} = 20.86$ years, $SD_{\text{age}} = 1.95$ years; 24 female, $M_{\text{age}} = 20.75$ years, $SD_{\text{age}} = 4.64$ years); and 25 in the combined condition (5 male, $M_{\text{age}} = 20.20$, $SD_{\text{age}} = 1.10$; 20 female, $M_{\text{age}} = 20.20$ years, $SD_{\text{age}} = 2.71$ years). Participants were predominantly from health-related faculties of the University (i.e., baseline = 76.10%; follow-up = 82.10%).

Measures¹¹

Hazardous alcohol consumption. We used the Alcohol Use Disorders Identification Test (AUDIT-C; Bush, Kivlahan, McDonell, Fihn, & Bradley, 1998) as an indication of hazardous alcohol consumption. The AUDIT-C comprises four statements regarding hazardous alcohol consumption behaviour and outcomes (e.g., “How often did you have a drink containing alcohol in the past year?”), with responses scored from 0 (e.g., “never”) to 4 (e.g., “6 or more times a week”), and is summed to derive a total score ranging from 0 to 12, with higher scores indicative of hazardous alcohol consumption.

Outcome measures. Participants reported their pre-drinking alcohol consumption for each of the previous four weeks in standard drink equivalents, with the aid of a pictorial guide detailing common beverage containers and their respective standard drink totals (National Health and Medical Research Council, 2009).

Alcohol-related harm was measured using the Brief Young Adult Alcohol Consequences Scale (B-YAACQ; Kahler, Strong, & Read, 2005), comprising 24 statements related to the experience of alcohol-related harm (e.g., “I have done something I have later regretted because of drinking”), with participants responding “yes” or “no” via radio button

¹¹ A complete list of measures is included in the appendix.

whether each statement is true of them. Although the B-YAACQ was developed for use over a 12-month period, we amended the time-frame to refer to the four-week period at baseline and follow-up, to ascertain an effect of the intervention, consistent with previous research (e.g., Kuntsche & Labhart, 2013).

Theory of planned behaviour measures. We measured participants' attitude, subjective norm, perceived behavioural control, and intentions, regarding reducing pre-drinking alcohol consumption between baseline and follow-up, based on previous research (Caudwell & Hagger, 2015). For attitude, we used a six-point bipolar adjective scale with a common stem ("reducing my pre-drinking alcohol consumption over the next four weeks would be... bad/good"). Subjective norm was assessed using three statements (e.g., "people who are important to me would want me to reduce my alcohol consumption during pre-drinking sessions") with participants responding on a scale from 1 ("strongly disagree") to 6 ("strongly agree").¹² Perceived behavioural control was also assessed using three statements (e.g., "If I wanted to, I could reduce my pre-drinking alcohol consumption") and a similar response scale from 1 ("strongly disagree") to 6 ("strongly agree"). Intention was measured using three items (e.g., "I intend to reduce my pre-drinking alcohol consumption over the next four weeks") and a similar response scale from 1 ("strongly disagree") to 6 ("strongly agree"). Item scores were averaged.

Self-determined goals. A measure of goal self-concordance (Koestner et al., 2006) was used to reflect the extent to which participants pursued the goal of reducing their pre-drinking alcohol consumption for autonomous or controlled reasons. Participants provided responses to four statements reflecting controlled (e.g., "because somebody wants me to, or because I'll get something from somebody if I do") and autonomous (e.g., "because you really believe that it's an important goal to have. You endorse it freely and value it wholeheartedly") reasons, on a Likert-type response scale from 1 ("not at all for this reason") to 9 ("completely because of this reason"). Scores on controlled items were subtracted from scores on autonomous items to derive an overall self-concordance score.

Planning ability. We included a measure of planning from the self-regulation questionnaire (Brown, Miller, & Lawendowski, 1999) to assess the planning ability of participants at baseline and follow-up. This measure consisted of nine items reflecting

¹²Scores for subjective norm are unavailable due to a programming error on the online questionnaire.

planning (e.g. “I have trouble making plans to help me reach my goals”), with response scales ranging from 1 (“strongly disagree”) to 5 (“strongly agree”). Item scores were averaged.

Results

Preliminary analyses¹³

Intervention condition variables. We developed two dichotomous variables to represent the intervention conditions for subsequent analyses. The variables denoted whether or not the participant received the autonomy support component (coded 0 or 1), or the implementation intention component (coded 0 or 1).

Alcohol-related variables. Average AUDIT-C scores at baseline were 4.57 (SD = 2.08), and the average pre-drinking alcohol consumption for the four weeks prior to was 18.24 standard drinks (SD = 18.76). Participant B-YAACQ average scores at baseline were 6.66 (SD = 4.16). These scores were largely consistent with previous research (Foster & Ferguson, 2013; Hallett et al., 2012; Pedersen, LaBrie, & Kilmer, 2009).

Randomization checks. To ascertain whether random allocation to conditions was successful, a MANOVA was conducted with intervention components (i.e., autonomy support: 0 or 1; implementation intention: 0 or 1) as the independent variables, and age, AUDIT-C score, attitude, perceived behavioural control, planning, intention, goal self-concordance, baseline pre-drinking alcohol consumption and alcohol-related harm as the dependent variables. The MANOVA showed no statistically significant main effect for the autonomy support ($F(9,170) = 1.51, p = .150$; Wilk’s $\Lambda = .93$; $\eta_p^2 = .07$) or implementation intention ($F(9,170) = .32, p = .968$; Wilk’s $\Lambda = .98$; $\eta_p^2 = .02$) components, nor a statistically significant interaction effect ($F(9,170) = 1.52, p = .144$; Wilk’s $\Lambda = .93$; partial $\eta_p^2 = .07$). A χ^2 test of contingencies showed no statistically significant difference in gender proportion between conditions: $\chi^2(3) = 2.04, p = .565$, Cramer’s $V = .10$.

Attrition checks. To check for any bias related to attrition, a multivariate analysis of variance (MANOVA) was conducted with completion status (baseline-only, $n = 61$; baseline and follow-up, $n = 109$) as the independent variable, and age, AUDIT-C score, attitude, perceived behavioural control, planning, intention, goal self-concordance, baseline pre-drinking alcohol consumption and alcohol-related harm, as the dependent variables. The

¹³ Note. For randomization and attrition checks, some data were missing due to participants not completing all measures.

MANOVA was not statistically significant ($F(9,160) = .64, p = .762$, Wilk's $\Lambda = .97$; $\eta_p^2 = .04$) indicating that participants who completed baseline-only did not significantly differ to those who went on to complete the follow-up in terms of their responses. Chi-square tests showed participant attrition was not related to either gender ($p = .820$, Cramer's $V = .02$), or condition ($p = .565$, Cramer's $V = .10$).

Manipulation checks. We compared mean scores on goal self-congruence between participants who received the autonomy support component of the intervention (i.e., those in the autonomy support and combined conditions) and those who did not (i.e., those in the control and implementation intention conditions), using a one-way analysis of covariance (ANCOVA) with a variable indicating whether participants received the autonomy support component of the intervention (coded 0 or 1), controlling for baseline self-congruence scores. The test was not statistically significant: $F(1,115) = 1.97, p = .163, \eta_p^2 = .02$, indicating goal self-concordance did not differ significantly between those who received an autonomy support manipulation ($M = 3.87; SE = .60$) and those who did not ($M = 2.66; SE = .63$). Participant responses to autonomy support prompts were coded for consistency, with 33 (61.10%) participants providing responses consistent with all four prompts, and the majority ($n = 48$ [88.90%]) providing responses consistent with at least three prompts.

The 55 participants who received the implementation intention component of the intervention selected and/or formed one or more implementation intentions, with the majority selecting or forming one ($n = 24$ [43.63%]), followed by two ($n = 19$ [35.55%]), three ($n = 8$ [14.55 %]), four ($n = 3$ [5.45 %]) and five ($n = 1$ [1.82 %]). Kruskal-Wallis tests indicated no statistically significant differences between the total number of implementation intentions selected or formed, for pre-drinking alcohol consumption ($\chi^2(5) = 4.52, p = .341$) and alcohol-related harm ($\chi^2(5) = 2.86, p = .581$). A total of 37 (66.27%) participants selected one or more experimenter-provided implementation intentions only, with 18 (33.73%) generating at least one implementation intention either in conjunction with an experimenter-provided (12), or outright (8). The self-generated implementation intentions were assessed for compliance with instructions, scored using a dichotomous scale as to whether the content complied (1) or not (0). Six of the self-generated implementation intentions were deemed non-compliant, and twelve were deemed compliant. Mann-Whitney U-tests indicated no difference between compliers ($Mdn_{PDAC} = 7.00; Mdn_{BYAACQ} = 3.00$) and non-compliers ($Mdn_{PDAC} = 3.50; Mdn_{BYAACQ} = 1.00$) in terms of pre-drinking alcohol consumption ($U = 31.50, z = -1.38, p = .169$) nor alcohol-related harm ($U = 25.00, z = -1.85, p = .065$).

Main analyses

The dummy-coded variables for intervention component (i.e., autonomy support: 0 or 1; implementation intention: 0 or 1) were entered as between-participants factors in mixed-model analyses of variance (ANOVA), with time (i.e., baseline, follow-up) entered as a within-participants variable, for the outcome variables. Both complete-case and intention-to-treat (using a last observation carried forward method [LOCF]) analyses were conducted¹⁴.

Effects of the intervention on pre-drinking alcohol consumption. For the complete case analysis, the assumptions of sphericity and equality of error variances were met (i.e., $ps > .05$). The ANOVA showed no statistically significant three-way interaction effect of time, autonomy support, and implementation intention ($F(1,113) = 2.19, p = .142, \eta_p^2 = .02$), no statistically significant two-way interaction of time and autonomy support ($F(1,113) = .02, p = .895, \eta_p^2 < .001$), and no statistically significant two-way interaction of time and implementation intention ($F(1,117) = .01, p = .944, \eta_p^2 < .01$) on pre-drinking alcohol consumption, leading us to reject H_1 . There was, however, a statistically significant main effect of time in pre-drinking alcohol consumption with a large effect size ($F(1,117) = 23.57, p < .001, \eta_p^2 = .17$). Participant pre-drinking alcohol consumption at baseline ($M = 15.90, SE = 1.01$) was significantly different from that at follow-up ($M = 10.29, SE = 1.13$); a difference of 5.61 standard drinks. There were no statistically significant main effects of autonomy support or implementation intention on pre-drinking alcohol consumption, leading us to reject H_2 and H_3 .

Effects of the intervention on alcohol-related harm. Both complete-case and intention-to-treat ANOVA were conducted. For the complete case analysis, the assumptions of sphericity and equality of error variances were met ($ps > .05$). The ANOVA revealed no statistically significant three-way interaction effect of time, autonomy support, and implementation intention ($F(1,113) = .46, p = .498, \eta_p^2 < .01$), or two-way interaction effects of time and autonomy support ($F(1,113) = .21, p = .644, \eta_p^2 < .01$) and time and implementation intention ($F(1,113) = .19, p = .663, \eta_p^2 < .01$) on alcohol-related harm, leading us to reject H_4 . A statistically significant effect of time on alcohol-related harm was observed, with a large effect size ($F(1,113) = 86.04, p < .001, \eta_p^2 = .43$). Participant B-YAACQ scores at baseline ($M = 6.34, SE = .36$) were significantly different from scores at

¹⁴ Results from ITT analyses were similar to the complete-case analyses, with the exception of the main effect of autonomy support, which was not statistically significant. These results are included in the appendix.

follow-up ($M = 3.36$, $SE = .32$); a difference of 2.98. We also found a statistically significant main effect of autonomy support on alcohol related harm with a small effect size ($F(1,113) = 4.62$, $p = .034$, $\eta_p^2 = .04$). Participants who did not receive autonomy support ($M = 4.21$, $SE = .41$) reported lower B-YAACQ scores than those who did ($M = 5.49$, $SE = .43$), a difference of 1.28, leading us to reject H_5 and H_6 .

Effects of the intervention on psychological variables. To check for an effect of the intervention on psychological variables, a MANCOVA was conducted with the intervention components (autonomy support and implementation intention) as independent variables, and attitude, perceived behavioural control, planning, intention, and goal self-concordance as the dependent variables with the baseline measurements for each variable included as covariates. Results revealed no main multivariate effect for the autonomy support ($F(5,105) = 1.61$, $p = .165$, Wilk's $\Lambda = .93$, $\eta_p^2 = .07$) or implementation intention ($F(5,105) = 1.71$, $p = .140$, Wilk's $\Lambda = .93$, $\eta_p^2 = .08$), nor any interaction effect ($F(5,105) = 1.89$, $p = .102$, Wilk's $\Lambda = .92$, $\eta_p^2 = .08$) on the dependent variables. Baseline-adjusted averaged-item means for each psychological variable by intervention condition are included in Table 1.

Discussion

The aim of the present study was to test the efficacy of an online, psychological theory-based intervention, developed to target motivational and volitional phases of action by providing autonomy support and prompting the formation of implementation intentions, to reduce pre-drinking alcohol consumption in undergraduate students. While the study hypotheses were not supported, we found a strong, statistically significant effect of time independent of intervention components whereby participants reduced their pre-drinking alcohol consumption by 5.61 standard drinks, and experienced 1.96 fewer instances of alcohol-related harm, between baseline and follow-up. These reductions are important, given that university students experience a range of negative academic and personal outcomes associated with theirs and others' alcohol consumption (Burns et al., 2015; Hallett, Howat, et al., 2014), and recent meta-analytic evidence that suggests online college and university alcohol interventions show modest effects (Black, Mullan, & Sharpe, 2016). We found a main effect for autonomy support on alcohol-related harm but this was contrary to predictions such that participants who did not receive this component reported statistically significantly lower alcohol-related harm at follow-up than those that did. The lack of effects of the autonomy support and implementation intention components warrant further discussion and

raise questions over the efficacy of these components in changing pre-drinking behaviour. The observed changes in pre-drinking alcohol consumption and alcohol-related harm over time suggests that elements that were common to all conditions contributed to behaviour change (i.e., assessment of pre-drinking alcohol consumption and alcohol-related harm, provision of alcohol consumption guidelines to reduce the risk of alcohol-related harm, and sending of email summary and SMS reminders), and that the inclusion of additional theory-based components had no effect. The significant main effect of time on pre-drinking alcohol consumption and alcohol-related harm, and absence of any interaction effects for time, autonomy support and implementation intention, may indicate that some participants were interested enough in changing their pre-drinking behaviour to be receptive to any intervention components aimed at promoting reduced pre-drinking.

Research indicates that Australians are generally unaware of alcohol consumption guidelines, especially young adult Australians and heavy drinkers (Livingston, 2012), a similar finding to research from the UK (de Visser & Birch, 2012). There is some indication that the administration of outcome measures at baseline leads to *assessment reactivity* among control group participants, and that ‘attenuated’ versions of university and college alcohol consumption interventions can confer treatment effects (Kypri, Langley, Saunders, & Cashell-Smith, 2007; Scott-Sheldon, Carey, Kaiser, Knight, & Carey, 2016). Given that participants were required to quantify their alcohol consumption in standard drink equivalents prior to assignment to intervention conditions, it is likely that this assessment contributed to behaviour change. A question-behaviour effect (QBE; Sprott et al., 2006) may account in part for main effect of time on behaviour. The QBE has been associated with decreases in undesirable behaviour (e.g., binge drinking) in theory of planned behaviour studies (Mankarious & Kothe, 2015). Meta-analytic evidence from Wilding et al. (2016) shows that the QBE is larger in student samples and when questions relate to prediction or intention. In the present study, participants’ completion of theory-based measures that were phrased in terms of behaviour change may have caused change. However, it would be difficult to partial out the QBE from effects of the other information common to all intervention conditions without the inclusion of measurement-only and no measurement comparison groups.

In summary, reflecting on personal alcohol consumption in relation to national guidelines (i.e., during the intervention, and upon receiving the summary email and weekly SMS messages) may have also contributed to reductions in participants’ alcohol consumption. This is likely as SMS messages are thought to improve the efficacy of health

behaviour interventions through enhancing participant engagement (Alkhalidi et al., 2016; Fry & Neff, 2009). Although these SMS messages were structured in order to complement the intervention content (e.g., participants receiving the autonomy support component received congruently-framed messages), the lack of condition effect suggests these messages served a prompting function as opposed to a complementary one. The assessment of pre-drinking alcohol consumption and alcohol-related harm, provision of information on alcohol consumption limits that would reduce the risk of alcohol-related harm, and the receiving of an email summary and four once-weekly SMS reminders following the intervention, were sufficient in eliciting reductions in these outcome variables at follow-up.

A potential issue that may account for the lack of effects for either motivational or volitional approach may be participant compliance. Participants appeared to comply more with the autonomy support component than the implementation intention component, potentially due to the autonomy support component requiring more engagement and introspection from the participants, as opposed to the planning task. However, groups receiving the autonomy support component did not score significantly higher on goal self-concordance, suggesting that the manipulation was not sufficient at facilitating autonomous motivation to reduce pre-drinking alcohol consumption. Previous research on online motivational interviewing has investigated how the level of engagement offered to participants influences their perceptions of an online motivational interviewing intervention (Friederichs et al., 2015). Specifically, participants who were able to reflect on their open-ended answers by selecting multiple choice options that best fit their responses, reported higher perceived relevance of the intervention, higher perceived ability to express and elaborate on their answers, and higher overall appreciation, than participants who received open-ended or multiple-choice-only response options (Friederichs et al., 2015). Self-determination theory-based interventions have also been more intensive, delivered ‘face-to-face’, often involving repeated interactions with practitioners (Fortier, Duda, Guerin, & Teixeira, 2012). The optimisation of participant compliance and engagement with online self-determination theory-based interventions may be of consideration in future research in this area.

Compliance with implementation intentions was generally limited, with many participants failing to generate statements that complied with instructions and examples provided, or providing responses that were not congruent with the goal of reducing pre-drinking alcohol consumption. Given that the implementation intention component was

developed following many of the recommendations of planning intervention components as outlined by (Hagger et al., 2016), this may indicate a problem for the application of online implementation intention interventions to pre-drinking behaviour. Epton et al. (2014) found similar, engagement-related issues, with university students participating in a theory-based intervention targeting multiple health behaviours, postulating that certain methodological issues such as the length of the baseline questionnaire, and commencement of the intervention during busy periods during semester, likely contributed to a lack of participant engagement. It is possible that similar factors influenced participants' engagement and compliance in the present study. A further issue lies in some participants' producing naive or unrealistic plans that likely would have been met with limited success (e.g., "If I feel tipsy then I will stop drinking"). It is likely that prompting participants to consider contingencies in implementation intentions (i.e., to address barriers or obstacles to successful goal attainment), or increasing the emphasis on the formation of simple and specific plans, may be useful. This may be especially relevant in the university student population, where alcohol consumption is synonymous with identity and socialisation, and attempts to moderate or refuse to drink excessively may be especially challenging (Leontini et al., 2015; Oei & Morawska, 2004). Other possible factors regarding the lack of effect of implementation intentions on behaviour change could be that participants who opted for one or both of the experimenter-provided implementation intentions may have simply selected these options as they were easier than generating their own, or to expedite progression through the intervention. It is likely that the cues outlined in the experimenter-provided implementation intentions did not arise following the intervention (e.g., the participant was not offered a drink). Future research may measure participant commitment to, and perceived success of, their implementation intentions, and assess plan recall, to ascertain whether these factors influence behaviour change and goal attainment.

Strengths, limitations, and future directions

The present study has several strengths and limitations that should be considered in light of the findings. The online intervention delivery afforded a cost-effective means to reach a large proportion of university students in a preferred medium, as well as a means of testing an online autonomy supportive intervention (Friederichs et al., 2015; Kypri et al., 2003). The use of a randomized controlled design, testing both the autonomy support and implementation intention approaches in isolation and combination, can be considered a strength, adding to previous research in this area (Koestner et al., 2006). An important

consideration in interpreting the findings of the present study relates to the outcome measures used. The accuracy of participants in recalling alcohol consumption is limited, however may be underestimated (de Visser & Birch, 2012; Monk, Heim, Qureshi, & Price, 2015).

Similarly, the modification of the B-YAACQ to refer to the previous four weeks may have altered the adequacy of the measure in accounting for short-term change (e.g., it may be less likely that students would encounter certain instances of alcohol-related harm referred to in the measure over a four-week period).

Although the use of email summary and SMS reminders were implemented to enhance the efficacy of the intervention components, we are unable to ascertain if these methods complemented the intervention techniques as intended. It may be that SMS reminders that are more aligned with participant responses (e.g., that reiterate or summarize their content), and measurement of their influence from the perspectives of participants, would elucidate this issue. Isolating the impact of these messages in future studies adopting a factorial design including message and no message conditions would elucidate the independent and interactive effects of messaging on behavioural outcomes. Future research may also consider allowing participants to compose their own SMS reminders, or opt for goal (e.g., reducing pre-drinking alcohol consumption) or plan (e.g., implementation intention) reminders (Prestwich, Perugini, & Hurling, 2010; Wright, Dietze, Crockett, & Lim, 2016). The relatively short intervention length, or the low ‘dosage’, may have limited the efficacy of the intervention in eliciting behaviour change through the autonomy support and/or implementation intention components. Increased researcher or health practitioner involvement (e.g., assessing the suitability of participant responses to intervention prompts) and ‘booster doses’ could be used to maintain autonomous motivation, or allow for alternative implementation intentions to be adopted.

Compliance issues also limit the extent to which the lack of implementation intention effect can be attributed to the technique itself, or failure to form suitable implementation intentions that led to the reduction in outcome measures. The length of follow-up also precludes any speculation of the effectiveness of the component over longer periods of time, as opportunities to enact plans become evident, or the decision to reduce pre-drinking alcohol consumption becomes more internalized and autonomously-motivated (Koestner, Powers, Milyavskaya, Carbonneau, & Hope, 2015; Ng et al., 2012). Given the absence of a significant effect at the follow-up period, a lagged time effect may be minimal.

A prominent limitation in the present study concerns the power of the intervention to detect significant interaction effects between condition and time on pre-drinking alcohol consumption (PDAC) and B-YAACQ scores (i.e., the outcome measures). A *post-hoc* power analysis was conducted to ascertain power to detect the (1) three-way interaction effect of autonomy support, implementation intentions, and time on outcome measures; (2) the two-way interaction of autonomy support and time on outcome measures and; (3) the two-way interaction of implementation intentions and time on outcome measures. The power to detect each of these effects was .72, .07, and .41 for the effect on PDAC; and .39 for each of the effects on B-YAACQ scores, using the complete-case sample. Power to detect the effect of time was sufficient at .98. It is evident that the study was not powered to detect small interaction effects. It is likely that the substantial effect of time warranted a larger sample size to increase the power to detect these smaller effects (Mohr et al., 2009).

Conclusion

The present study used motivational and volitional techniques (i.e., autonomy support and implementation intentions) from psychological theories of health behaviour to reduce pre-drinking alcohol consumption and alcohol-related harm in a group of undergraduates. These techniques did not lead to more substantial reductions in these outcome measures in isolation, or in combination, than that experienced by participants in a control group. Given all participants were assessed on outcome variables at baseline, provided with information on alcohol consumption limits to reduce the per-occasion and lifetime risk of alcohol-related harm, and email summary and SMS reminders, this may have been sufficient to account for behaviour change. Future research should attempt to ascertain whether this effect can be replicated in multiple samples in similar contexts.

Table 1. *Means and Standard Deviations of Outcome Variables by Condition*

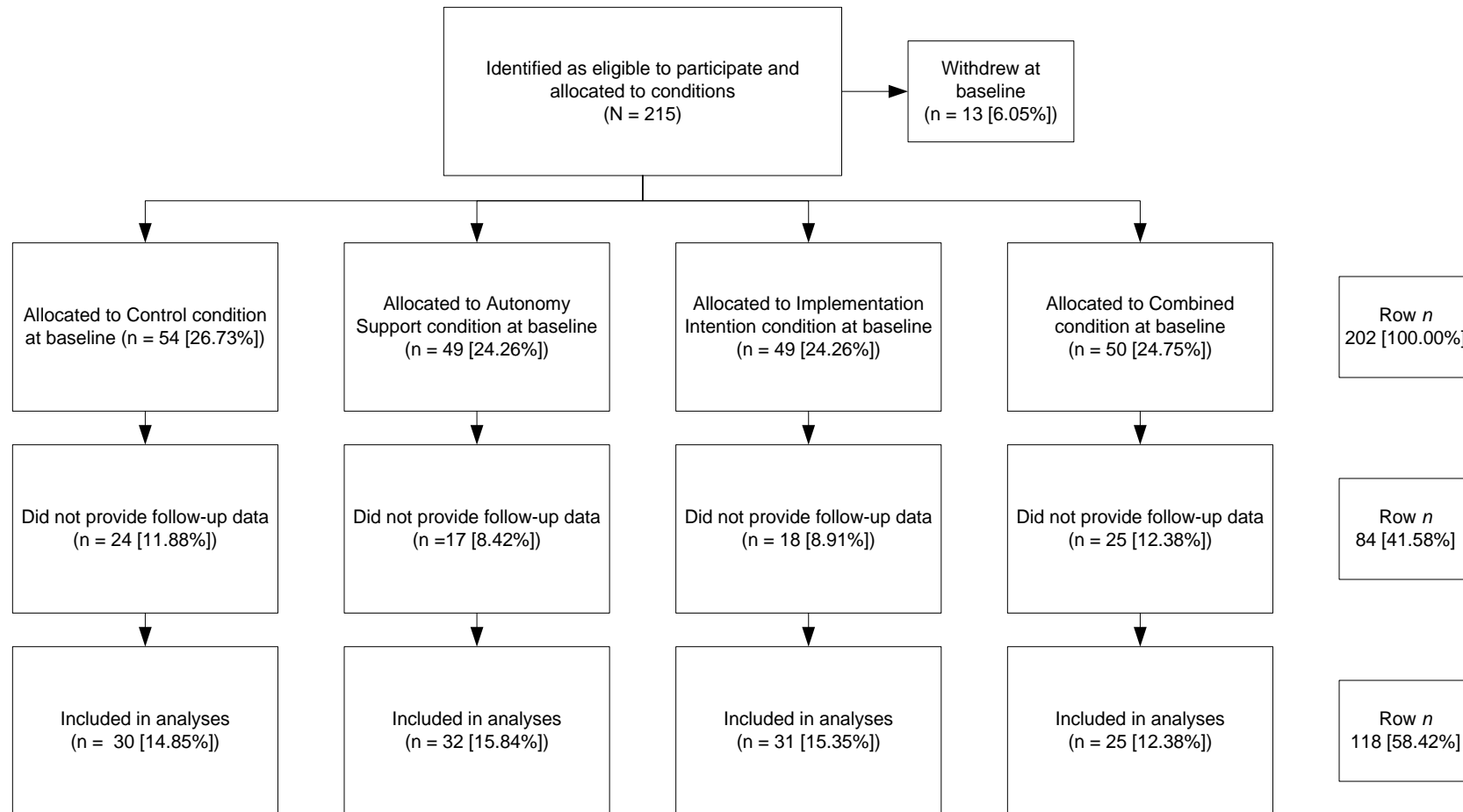
	Intervention Condition															
	Control				Autonomy Support				Implementation Intention				Combined			
	Baseline		Follow-up		Baseline		Follow-up		Baseline		Follow-up		Baseline		Follow-up	
Measure	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
PDAC	15.30	18.56	11.17	16.20	17.34	18.44	10.09	8.39	17.58	15.53	10.09	8.39	13.38	16.13	9.70	8.99
B-YAACQ	5.60	3.31	2.83	3.17	6.81	4.48	3.91	4.19	5.94	3.20	2.45	2.80	7.00	4.34	4.25	3.34

Note. PDAC = pre-drinking alcohol consumption; B-YAACQ = Brief Young Adult Alcohol Consequences Questionnaire

Table 2. *Baseline-adjusted Means for Averaged Item Psychological Variables*

Measure	Intervention Condition							
	Control		Autonomy Support		Implementation Intention		Combined	
	<i>M</i>	<i>SE</i>	<i>M</i>	<i>SE</i>	<i>M</i>	<i>SE</i>	<i>M</i>	<i>SE</i>
GSC	3.76	.86	2.74	.88	4.30	.85	2.18	.91
Attitude	4.00	.15	4.73	.16	4.34	.15	4.13	.16
PBC	5.25	.09	5.28	.09	5.04	.09	5.06	.10
Intention	3.71	.19	4.08	.19	4.15	.19	3.87	.20
Planning	3.31	.09	3.31	.09	3.18	.09	3.30	.09

Note. Statistics reported are means and standard errors, controlling for baseline measures. GSC = goal self-concordance; PBC = perceived behavioural control.

Figure 1. *Participant Flow Diagram*

References

- Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, 50(2), 179-211. doi:10.1016/0749-5978(91)90020-t
- Alkhaldi, G., Hamilton, F. L., Lau, R., Webster, R., Michie, S., & Murray, E. (2016). The effectiveness of prompts to promote engagement with digital interventions: A systematic review. *Journal of Medical Internet Research*, 18(1).
- Armitage, C. J. (2009). Effectiveness of experimenter-provided and self-generated implementation intentions to reduce alcohol consumption in a sample of the general population: a randomized exploratory trial. *Health Psychology*, 28(5), 545.
- Barratt, E. S., Patton, J., & Stanford, M. (1975). *Barratt Impulsiveness Scale*. Barratt-Psychiatry Medical Branch, University of Texas.
- Barry, A. E., Stellefson, M. L., Piazza-Gardner, A. K., Chaney, B. H., & Dodd, V. (2013). The impact of pregameing on subsequent blood alcohol concentrations: An event-level analysis. *Addictive Behaviors*, 38(8), 2374-2377. doi:10.1016/j.addbeh.2013.03.014
- Black, N., Mullan, B., & Sharpe, L. (2016). Computer-delivered interventions for reducing alcohol consumption: Meta-analysis and meta-regression using behaviour change techniques and theory. *Health Psychology Review*, 10(3), 341-357. doi:10.1080/17437199.2016.1168268
- Brown, J. M., Miller, W. R., & Lawendowski, L. A. (1999). The self-regulation questionnaire. In L. VandeCreek & T. L. Jackson (Eds). *Innovations in clinical practice: A source book* (pp. 281-292). Sarasota, FL, USA: Professional Resource Exchange.
- Burns, S., Crawford, G., Hallett, J., Jancey, J., Portsmouth, L., Hunt, K., & Longo, J. (2015). Consequences of low risk and hazardous alcohol consumption among university students in Australia and implications for health promotion interventions. *Open Journal of Preventive Medicine*, Vol.05No.01, 13. doi:10.4236/ojpm.2015.51001
- Bush, K., Kivlahan, D. R., McDonell, M. B., Fihn, S. D., & Bradley, K. A. (1998). The AUDIT alcohol consumption questions (AUDIT-C): an effective brief screening test for problem drinking. *Archives of Internal Medicine*, 158(16), 1789. doi:10.1001/archinte.158.16.1789
- Caudwell, K. M., & Hagger, M. S. (2015). Predicting alcohol pre-drinking in Australian undergraduate students using an integrated theoretical model. *Applied Psychology: Health and Well-Being*, 7(2), 188-213. doi:10.1111/aphw.12044

- Cooke, R., Dahdah, M., Norman, P., & French, D. P. (2014). How well does the theory of planned behaviour predict alcohol consumption? A systematic review and meta-analysis. *Health Psychology Review* 10(2), 148-167. doi: 10.1080/17437199.2014.947547
- de Visser, R. O., & Birch, J. D. (2012). My cup runneth over: Young people's lack of knowledge of low-risk drinking guidelines. *Drug and Alcohol Review*, 31(2), 206-212. doi:10.1111/j.1465-3362.2011.00371.x
- Deci, E. L., & Ryan, R. M. (1985). *Intrinsic motivation and self-determination in human behaviour*. New York: Plenum.
- Deci, E. L., & Ryan, R. M. (2000). The "what" and "why" of goal pursuits: Human needs and the self-determination of behavior. *Psychological Inquiry*, 11(4), 227-268. doi:10.1207/S15327965PLI1104_01
- Dick, D. M., Smith, G., Olausson, P., Mitchell, S. H., Leeman, R. F., O'Malley, S. S., & Sher, K. (2010). Review: Understanding the construct of impulsivity and its relationship to alcohol use disorders. *Addiction Biology*, 15(2), 217-226. doi:10.1111/j.1369-1600.2009.00190.x
- Epton, T., Norman, P., Dadzie, A.-S., Harris, P. R., Webb, T. L., Sheeran, P., . . . Shah, I. (2014). A theory-based online health behaviour intervention for new university students (U@Uni): results from a randomised controlled trial. *BMC Public Health*, 14(1), 563. doi:10.1186/1471-2458-14-563
- Fortier, M. S., Duda, J. L., Guerin, E., & Teixeira, P. J. (2012). Promoting physical activity: development and testing of self-determination theory-based interventions. *International Journal of Behavioral Nutrition and Physical Activity*, 9(1), 1-14. doi:10.1186/1479-5868-9-20
- Foster, J. H., & Ferguson, C. (2013). Alcohol 'pre-loading': A review of the literature. *Alcohol and Alcoholism*, agt135.
- Friederichs, S. A., Oenema, A., Bolman, C., Guyaux, J., Van Keulen, H. M., & Lechner, L. (2015). Motivational interviewing in a web-based physical activity intervention: questions and reflections. *Health Promotion International*, 30(3), 803-815. doi:10.1093/heapro/dat069
- Fry, J. P., & Neff, R. A. (2009). Periodic prompts and reminders in health promotion and health behavior interventions: systematic review. *Journal of Medical Internet Research*, 11(2), doi:10.2196/jmir.1138

- Gollwitzer, P. M. (1999). Implementation intentions: strong effects of simple plans. *American Psychologist*, 54(7), 493. doi:10.1037/0003-066X.54.7.493
- Gollwitzer, P. M., & Brandstätter, V. (1997). Implementation intentions and effective goal pursuit. *Journal of Personality and Social Psychology*, 73(1), 186. doi:10.1037/0022-3514.73.1.186
- Gullo, M. J., Dawe, S., Kambouropoulos, N., Staiger, P. K., & Jackson, C. J. (2010). Alcohol expectancies and drinking refusal self-efficacy mediate the association of impulsivity with alcohol misuse. *Alcoholism: Clinical and Experimental Research*, 34(8), 1386-1399. doi:10.1111/j.1530-0277.2010.01222.x
- Hagger, M. S., & Chatzisarantis, N. L. D. (2009). Integrating the theory of planned behaviour and self-determination theory in health behaviour: A meta-analysis. *British Journal of Health Psychology*, 14(2), 275-302. doi:10.1348/135910708x373959
- Hagger, M. S., Lonsdale, A., & Chatzisarantis, N. L. D. (2012). A theory-based intervention to reduce alcohol drinking in excess of guideline limits among undergraduate students. *British Journal of Health Psychology*, 17(1), 18-43. doi:10.1111/j.2044-8287.2010.02011.x
- Hagger, M. S., Lonsdale, A. J., Koka, A., Hein, V., Pasi, H., Lintunen, T., & Chatzisarantis, N. L. D. (2012). An intervention to reduce alcohol consumption in undergraduate students using implementation intentions and mental simulations: A cross-national study. *International Journal of Behavioral Medicine*, 19(1), 82-96.
- Hagger, M. S., Luszczynska, A., de Wit, J., Benyamini, Y., Burkert, S., Chamberland, P.-E., . . . French, D. P. (2016). Implementation intention and planning interventions in Health Psychology: Recommendations from the Synergy Expert Group for research and practice. *Psychology & Health*, 31(7), 814-839. doi:10.1080/08870446.2016.1146719
- Hallett, J., Howat, P., Maycock, B., McManus, A., Kypri, K., & Dhaliwal, S. (2012). Undergraduate student drinking and related harms at an Australian university: web-based survey of a large random sample. *BMC Public Health*, 12(1), 37. doi:10.1186/1471-2458-12-37
- Hallett, J., Howat, P., McManus, A., Meng, R., Maycock, B., & Kypri, K. (2014). Academic and personal problems among Australian university students who drink at hazardous levels: web-based survey. *Health Promotion Journal of Australia*, 24(3), 170-177.
- Hallett, J., McManus, A., Maycock, B. R., Smith, J., & Howat, P. M. (2014). "Excessive Drinking - an inescapable part of university life?" A focus group study of Australian

- undergraduates. *Open Journal of Preventive Medicine*, 4(7), 14.
doi:10.4236/ojpm.2014.47071
- Hardeman, W., Johnston, M., Johnston, D. W., Bonetti, D., Wareham, N. J., & Kinmonth, A. L. (2002). Application of the theory of planned behaviour in behaviour change interventions: A systematic review. *Psychology & Health*, 17(2), 123-158.
- Heckhausen, H. (1991). The rubicon model of action phases. In H. Heckhausen (Ed.), *Motivation and Action*. New York: Springer-Verlag.
- Henges, A. L., & Marczinski, C. A. (2012). Impulsivity and alcohol consumption in young social drinkers. *Addictive Behaviors*, 37(2), 217-220. doi: 10.1016/j.addbeh.2011.09.013
- Kahler, C. W., Strong, D. R., & Read, J. P. (2005). Toward efficient and comprehensive measurement of the alcohol problems continuum in college students: The Brief Young Adult Alcohol Consequences Questionnaire. *Alcoholism: Clinical and Experimental Research*, 29(7), 1180-1189.
doi:10.1097/01.ALC.0000171940.95813.A5
- Karam, E., Kypri, K., & Salamoun, M. (2007). Alcohol use among college students: An international perspective. *Current Opinion in Psychiatry*, 20(3), 213-221.
doi:10.1097/YCO.0b013e3280fa836c
- Koestner, R., Horberg, E., Gaudreau, P., Powers, T., Di Dio, P., Bryan, C., . . . Salter, N. (2006). Bolstering implementation plans for the long haul: The benefits of simultaneously boosting self-concordance or self-efficacy. *Personality and Social Psychology Bulletin*, 32(11), 1547-1558. doi:10.1177/0146167206291782
- Koestner, R., Lekes, N., Powers, T. A., & Chicoine, E. (2002). Attaining personal goals: Self-concordance plus implementation intentions equals success. *Journal of Personality & Social Psychology*, 83(1), 231-244.
- Koestner, R., Powers, T. A., Milyavskaya, M., Carbonneau, N., & Hope, N. (2015). Goal internalization and persistence as a function of autonomous and directive forms of goal support. *Journal of Personality*, 83(2), 179-190. doi:10.1111/jopy.12093
- Kuntsche, E., & Labhart, F. (2013). Drinking motives moderate the impact of pre-drinking on heavy drinking on a given evening and related adverse consequences—an event-level study. *Addiction*, 108(10), 1747-1755. doi:10.1111/add.12253
- Kypri, K., Cronin, M., & Wright, C. S. (2005). Do university students drink more hazardously than their non-student peers? *Addiction*, 100(5), 713-714.

- Kypri, K., Langley, J. D., Saunders, J. B., & Cashell-Smith, M. L. (2007). Assessment may conceal therapeutic benefit: findings from a randomized controlled trial for hazardous drinking. *Addiction*, 102(1), 62-70 69p.
- Kypri, K., Saunders, J. B., & Gallagher, S. J. (2003). Acceptability of various brief intervention approaches for hazardous drinking among university students. *Alcohol and Alcoholism*, 38(6), 626-628. doi:10.1093/alcalc/agg121
- Labhart, F., Graham, K., Wells, S., & Kuntsche, E. (2013). Drinking before going to licensed premises: An event-level analysis of predrinking, alcohol consumption, and adverse outcomes. *Alcoholism: Clinical and Experimental Research*, 37(2), 284-291. doi:10.1111/j.1530-0277.2012.01872.x
- Larimer, M. E., & Crouce, J. M. (2007). Identification, prevention, and treatment revisited: Individual-focused college drinking prevention strategies 1999–2006. *Addictive Behaviors*, 32(11), 2439-2468. doi:10.1016/j.addbeh.2007.05.006
- Leontini, R., Schofield, T., Lindsay, J., Brown, R., Hepworth, J., & Germov, J. (2015). “Social Stuff” and institutional micro-processes alcohol use by students in Australian university residential colleges. *Contemporary Drug Problems*, 0091450915580970.
- Livingston, M. (2012). Perceptions of low-risk drinking levels among Australians during a period of change in the official drinking guidelines. *Drug and Alcohol Review*, 31(2), 224-230. doi:10.1111/j.1465-3362.2011.00414.x
- Mankarious, E., & Kothe, E. (2015). A meta-analysis of the effects of measuring theory of planned behaviour constructs on behaviour within prospective studies. *Health Psychology Review*, 9(2), 190-204. doi:10.1080/17437199.2014.927722
- Miller, P. G., & Droste, N. (2013). Alcohol price considerations on alcohol and illicit drug use in university students. *Journal of Alcoholism and Drug Dependence*, 1(2), 1-4. doi:10.4172/jaldd.1000109
- Mohr, D. C., Spring, B., Freedland, K. E., Beckner, V., Arean, P., Hollon, S. D., . . . Kaplan, R. (2009). The selection and design of control conditions for randomized controlled trials of psychological interventions. *Psychotherapy and Psychosomatics*, 78(5), 275-284. doi:10.1159/000228248
- Monk, R. L., Heim, D., Qureshi, A., & Price, A. (2015). “I have no clue what I drunk last night” Using smartphone technology to compare in-vivo and retrospective self-reports of alcohol consumption. *PloS One*, 10(5), e0126209.

- Mullan, B., Todd, J., Chatzisarantis, N. L. D., & Hagger, M. S. (2014). Experimental methods in health psychology in Australia: Implications for applied research. *Australian Psychologist*, 49(2), 104-109. doi:10.1111/ap.12046
- Mullan, B., Wong, C., Allom, V., & Pack, S. L. (2011). The role of executive function in bridging the intention-behaviour gap for binge-drinking in university students. *Addictive Behaviors*, 36(10), 1023-1026.
- Murgraff, V., Abraham, C., & McDermott, M. (2007). Reducing Friday alcohol consumption among moderate, women drinkers: Evaluation of a brief evidence-based intervention. *Alcohol and Alcoholism*, 42(1), 37-41. doi:10.1093/alcalc/agl083
- Murgraff, V., White, D., & Phillips, K. (1996). Moderating binge drinking: It is possible to change behaviour if you plan it in advance. *Alcohol and Alcoholism*, 31(6), 577-582.
- National Health and Medical Research Council. (2009). *Australian guidelines to reduce risks from drinking alcohol*. Canberra, ACT: Commonwealth of Australia.
- Neighbors, C., Larimer, M. E., & Lewis, M. A. (2004). Targeting misperceptions of descriptive drinking norms: efficacy of a computer-delivered personalized normative feedback intervention. *Journal of Consulting and Clinical Psychology*, 72(3), 434. doi:10.1037/0022-006X.72.3.434
- Ng, J. Y. Y., Ntoumanis, M., Thøgersen-Ntoumani, C., Deci, E. L., Ryan, R. M., Duda, J. L., & Williams, G. C. (2012). Self-determination theory applied to health contexts. *Perspectives on Psychological Science*, 7(4), 325-340. doi:10.1177/1745691612447309
- Oei, T. P. S., & Morawska, A. (2004). A cognitive model of binge drinking: The influence of alcohol expectancies and drinking refusal self-efficacy. *Addictive Behaviors*, 29(1), 159-179. doi:10.1016/s0306-4603(03)00076-5
- Orbell, S., & Sheeran, P. (1998). 'Inclined abstainers': A problem for predicting health-related behaviour. *British Journal of Social Psychology*, 37(2), 151-165. doi:10.1111/j.2044-8309.1998.tb01162.x
- Pavey, L. J., & Sparks, P. (2010). Autonomy and reactions to health-risk information. *Psychology & Health*, 25(7), 855-872. doi:10.1080/08870440902929528
- Pavey, L. J., & Sparks, P. (2011). Autonomy and defensiveness: Experimentally increasing adaptive responses to health-risk information via priming and self-affirmation. *Psychology & Health*, 27(3), 259-276. doi:10.1080/08870446.2011.556251

- Pedersen, E. R. (2016). Using the solid research base on pregameing to begin intervention development: An epilogue to the special issue on pregameing. *Substance Use & Misuse*, 51, 1067-1073. doi:10.1080/10826084.2016.1187533
- Pedersen, E. R., & LaBrie, J. W. (2007). Partying before the party: Examining prepartying behavior among college students. *Journal of American College Health*, 56(3), 237-245. doi:10.3200/JACH.56.3.237-246
- Pedersen, E. R., LaBrie, J. W., & Kilmer, J. R. (2009). Before you slip into the night, you'll want something to drink: exploring the reasons for prepartying behavior among college student drinkers. *Issues in Mental Health Nursing*, 30(6), 354-363. doi:10.1080/01612840802422623
- Pelletier, L. G., Fortier, M. S., Vallerand, R. J., & Briere, N. M. (2001). Associations among perceived autonomy support, forms of self-regulation, and persistence: A prospective study. *Motivation and Emotion*, 25(4), 279-306. doi:10.1023/A:1014805132406
- Prestwich, A., Perugini, M., & Hurling, R. (2010). Can implementation intentions and text messages promote brisk walking? A randomized trial. *Health Psychology*, 29(1), 40. doi:10.1037/a0016993
- Reed, M. B., Clapp, J. D., Weber, M., Trim, R., Lange, J., & Shillington, A. M. (2011). Predictors of partying prior to bar attendance and subsequent BrAC. *Addictive Behaviors*, 36(12), 1341-1343. doi:10.1016/j.addbeh.2011.07.029
- Scott-Sheldon, L. A. J., Carey, K. B., Elliott, J. C., Garey, L., & Carey, M. P. (2014). Efficacy of alcohol interventions for first-year college students: A meta-analytic review of randomized controlled trials. *Journal of Consulting and Clinical Psychology*, 82(2), 177.
- Scott-Sheldon, L. A. J., Carey, K. B., Kaiser, T. S., Knight, J. M., & Carey, M. P. (2016). Alcohol interventions for Greek letter organizations: A systematic review and meta-analysis, 1987 to 2014. *Health Psychology*, 35(7), 670-684. doi:10.1037/hea0000357
- Slutske, W. S., Hunt-Carter, E. E., Nabors-Oberg, R. E., Sher, K. J., Bucholz, K. K., Madden, P. A. F., . . . Heath, A. C. (2004). Do college students drink more than their non-college-attending peers? Evidence from a population-based longitudinal female twin study. *Journal of Abnormal Psychology*, 113(4), 530-540.
- Sniehotta, F. F., Scholz, U., & Schwarzer, R. (2005). Bridging the intention-behaviour gap: Planning, self-efficacy, and action control in the adoption and maintenance of physical exercise. *Psychology & Health*, 20(2), 143-160. doi:10.1348/014466604X17452

- Sprott, D. E., Spangenberg, E. R., Block, L. G., Fitzsimons, G. J., Morwitz, V. G., & Williams, P. (2006). The question-behavior effect: What we know and where we go from here. *Social Influence*, 1(2), 128-137. doi:10.1080/15534510600685409
- Su, Y.-I., & Reeve, J. (2011). A meta-analysis of the effectiveness of intervention programs designed to support autonomy. *Educational Psychology Review*, 23(1), 159-188. doi:10.1007/s10648-010-9142-7
- Webb, T. L., Joseph, J., Yardley, L., & Michie, S. (2010). Using the internet to promote health behavior change: A systematic review and meta-analysis of the impact of theoretical basis, use of behavior change techniques, and mode of delivery on efficacy. *Journal of Medical Internet Research*, 12(1). doi:10.2196/jmir.1376
- Wells, S., Graham, K., & Purcell, J. (2009). Policy implications of the widespread practice of 'pre-drinking' or 'pre-gaming' before going to public drinking establishments - Are current prevention strategies backfiring? *Addiction*, 104(1), 4-9. doi:10.1111/j.1360-0443.2008.02393.x
- White, A. W., Kavanagh, D., Stallman, H., Klein, B., Kay-Lambkin, F., Proudfoot, J., . . . Hines, E. (2010). Online alcohol interventions: A systematic review. *Journal of Medical Internet Research*, 12(5).
- Wilding, S., Conner, M., Sandberg, T., Prestwich, A., Lawton, R., Wood, C., . . . Sheeran, P. (2016). The question-behaviour effect: A theoretical and methodological review and meta-analysis. *European Review of Social Psychology*, 27(1), 196-230. doi:10.1080/10463283.2016.1245940
- Wright, C. J., Dietze, P. M., Crockett, B., & Lim, M. S. (2016). Participatory development of MIDY (Mobile Intervention for Drinking in Young people). *BMC Public Health*, 16(1), 1-11. doi:10.1186/s12889-016-2876-5

CHAPTER VII: GENERAL SUMMARY AND DISCUSSION

Summary of findings

Three aims of the present research programme were to (1) develop a better understanding of the theory-based antecedents of pre-drinking behaviour in university students; (2) how these antecedents operate in relation to each other to predict pre-drinking; and; drawing from this formative research, (3) to develop and test an online, theory-based intervention to reduce pre-drinking alcohol consumption and alcohol-related harm in university students, comprised of techniques from component theories and research findings.

The first study (Chapter II) detailed the application of a motivational sequence model drawing from self-determination theory and the theory of planned behaviour to predict students' engagement in pre-drinking sessions. Results indicated that this model accounted for substantial variance in pre-drinking intentions, however intention accounted for little variance in pre-drinking behaviour. In terms of the patterns of effects, strong, positive paths between autonomous motivation and attitude and subjective norm, were observed, and between autonomous motivation and intentions to engage in pre-drinking. Weak, negative paths between controlled motivation and attitudes, and perceived behavioural control, were observed. The path between controlled motivation and attitude was weak in comparison to that of autonomous motivation and attitude, indicating the latter is more associated with the formation of positive attitudes regarding pre-drinking, which underlie intention. Overall, there was little support for these constructs accounting for variance in engagement in pre-drinking behaviour. The size of the path between intention and pre-drinking behaviour indicated that other variables not accounted for in the model tested may have influenced pre-drinking behaviour.

The second study (Chapter III) took a dual-systems approach to ascertain the influence of explicit and implicit constructs in accounting for variance in pre-drinking alcohol consumption and alcohol-related harm. A measure of pre-drinking motives was selected to represent a reflective, explicit process, and an implicit association test for alcohol identity was selected to represent an underlying impulsive process. Explicit motive dimensions of interpersonal enhancement, barriers to consumption, and situational control, as well as a measure of cost motive, were associated with both outcome measures: students' typical pre-drinking alcohol consumption, and reported experience of alcohol-related harm. Positive associations were observed between interpersonal enhancement, barriers to consumption, and

pre-drinking alcohol consumption and alcohol-related harm, and situational control was negatively associated with both outcome measures (i.e., participants who strongly endorsed exert control over pre-drinking reported consuming less alcohol and experiencing less alcohol-related harm). Intimate pursuit was not significantly associated with either outcome measure, indicating it may not be a relevant motive underlying pre-drinking among undergraduates. These findings demonstrate the importance of socialisation (i.e., interpersonal enhancement) and practicality (i.e., barriers to consumption, situational control, cost) that pre-drinking offers individuals, that are not evident in other alcohol consumption environments (e.g., Barton & Husk, 2014). Implicit alcohol identity was positively associated with alcohol-related harm, but not with pre-drinking alcohol consumption. This was interpreted as the construct predicting variance in pre-drinking alcohol consumption that was better accounted for by the explicit measures (owing potentially to their specificity to the target behaviour, as opposed to the generality of the implicit alcohol identity measure). These findings suggest a potential dual systems additive pattern of prediction whereby explicit and implicit processes are both involved in pre-drinking behaviour, and is broadly consistent with impulsive pathways to behaviour outlined by the Reflective-Impulsive Model applied to health behaviour (Hofmann et al., 2008; Perugini, 2005; Perugini, Richetin, & Zogmaister, 2010; Strack & Deutsch, 2004).

Building on the results of the previous studies, the next study (Chapter IV) applied an integrated behaviour-change model to participants' intentions to reduce their pre-drinking alcohol consumption. That implicit alcohol identity was included as a measure of impulsive processes allowed for a more comprehensive analysis of influential non-conscious processes related to reducing pre-drinking alcohol consumption. Results indicated a non-significant intention-behaviour relationship, with behaviour instead predicted directly by implicit alcohol identity and perceived behavioural control, with substantial influence of past behaviour. This suggested that the more contemporary hypothesis of the theory of planned behaviour did not hold in relation to reducing pre-drinking alcohol consumption, and, instead, provided support for the influences of impulsive processes and explicit control-related factors on pre-drinking behaviour, consistent with previous findings in Chapters II and III. Overall, the studies presented in Chapters II through IV provide evidence to suggest that pre-drinking is not entirely under intentional control. Consistent direct effects of perceived behavioural control on pre-drinking behaviour in these chapters suggests that individuals' perceptions of control are accurate and do not influence their behaviour through the intentional pathway.

Chapter V included a study protocol detailing an intervention based on the findings of the formative research and tenets of the component theories. Specifically, the intervention targeted both pre-implementation (i.e., motivational) and post-implementation (i.e., volitional) action phases (Heckhausen, 1991) using prescribed techniques from self-determination theory, and implementation intentions. To target the pre-implementation phase, participants completed a reflective autonomy support task to facilitate autonomous motivation to reduce pre-drinking alcohol consumption, and to target the post-implementation phase, participants formed implementation intentions to increase the likelihood they would act accordance with their intentions to reduce pre-drinking alcohol consumption. When combined, these approaches were thought to lead to more substantial reductions in pre-drinking alcohol consumption and alcohol-related harm relative to each condition with a single approach only, and a control condition, based on the synergistic effects of autonomy support and implementation intentions established in previous research (Koestner et al., 2006; Murgraff, White, & Phillips, 1996), with autonomy support facilitating participants' autonomous motivation in the pre-implementation phase, and implementation intentions effectively "bridging the gap" between intentions and behaviour in the post-implementation phase. Participants were randomly allocated via an online survey platform to one of four conditions: control, autonomy support-only, implementation intention-only, and combined. All participants were assessed on pre-drinking alcohol consumption and alcohol-related harm at baseline, before receiving National guidelines on alcohol consumption to lower the risk of alcohol-related harm. Participants in either the autonomy support-only or implementation intention-only conditions received these components next, and the participants in the combined condition received both components. After completion of the intervention, participants immediately received an email summarising their intervention content, and were sent a condition-relevant SMS each week, for four weeks. Analyses showed significant reductions in outcome measures, regardless of condition. This indicated that the content common to conditions - the only content the action control condition received - was responsible for behaviour change, and not the inclusion of theory-based behaviour change techniques.

These findings were consistent with alcohol consumption interventions that show control conditions to improve with the mere assessment of alcohol consumption, and that control conditions are often superior to more involved intervention components in eliciting reductions in alcohol-related variables (Kypri, Langley, Saunders, & Cashell-Smith, 2007; Scott-Sheldon, Carey, Kaiser, Knight, & Carey, 2016). However, it is important to discuss the

limitations of the theory-based approaches in eliciting meaningful behaviour change beyond the components common to all participants in the intervention. Given that Chapter IV and VI showed participants from the target population expressed relatively modest levels of motivation and intention to engage in reducing pre-drinking alcohol consumption, and that intention had limited effects on behaviour in Chapters II and IV, the attempt to facilitate autonomous motivation to promote consistent intentions that would lead to success in reducing pre-drinking alcohol consumption may have been difficult. Although the inclusion of implementation intentions was intended to help enact intentions in the volitional phase, the autonomy support manipulation was not effective in changing behaviour, and compliance with the implementation intention instructions was fairly limited. As discussed in Chapter VI, targeting the motivational phase of behaviour might be improved by including components that satisfy needs of competence and relatedness, although this might be difficult to implement practically. Interventions using implementation intentions might consider including further or more detailed instructions, or experimenter feedback, to ensure greater compliance and success in the volitional phase.

The studies included in this thesis have contributed to existing knowledge about undergraduate pre-drinking behaviour, and the findings of these studies have important implications theory and practice. Findings from Chapters III and IV are consistent with increasing evidence that pre-drinking carries perceived social and practical benefits, is influenced by cost, and likely occurs through the non-conscious, less deliberative processes that likely originate from repeated associations between alcohol stimuli and alcohol consumption over time. While the integration of self-determination theory and the theory of planned behaviour presents an important step in expanding the utility of these theories usually applied in isolation, the contributions of constructs from these theories to the prediction of pre-drinking behaviour was relatively limited, as demonstrated in Chapters II and IV. However, testing models drawing from the integration of these theories and the integrated behaviour change model framework outlined some potential means to promote behaviour change, explored in Chapter V and VI: the facilitation of autonomous motivation to reduce pre-drinking alcohol consumption, and the application of implementation intentions to facilitate the transition between intention formation and subsequent behaviour. Though, these strategies were no more successful than those implemented across experimental conditions (i.e., the constituents of the control group), the success of the intervention.

Implications for understanding the influences underlying pre-drinking

The studies included in this thesis make important contributions to the understanding of pre-drinking behaviour. The findings from Chapters II and III indicate strong links between the perceived social and practical benefits of pre-drinking, reflecting broader associations between alcohol consumption and the university and college student experience (Hallett, McManus, et al., 2014; Scott-Sheldon et al., 2016). For example, the study in Chapter II highlighted the socialisation function of pre-drinking (i.e., interpersonal enhancement), which was associated with the amount of alcohol pre-drinkers typically reported consuming. The study in Chapter III showed that individuals report autonomous motivation to engage in pre-drinking behaviour, and, that their intentions, based on these motivations, align somewhat with their engagement in pre-drinking sessions over the following month. This is an important finding, given that autonomous motivation is typically associated with engaging in healthy behaviours, and controlled motivation with unhealthy behaviours such as engaging in excessive alcohol consumption (Neighbors, Larimer, Markman Geisner, et al., 2004; Ng et al., 2012). A challenge for health practitioners is therefore to reduce the significant and unique risk of alcohol-related harm associated with pre-drinking, as participants report engaging in pre-drinking for reasons consistent with autonomous motivation. The results of the intervention detailed in Chapter V, and tested in Chapter VI, suggests that reductions in pre-drinking alcohol consumption may be achieved by the mere assessment of pre-drinking alcohol consumption behaviour and alcohol-related harm, the provision of guidelines on limiting alcohol consumption to reduce the risk of alcohol-related harm (that individuals may use to reflect on their own consumption), and the provision of summary emails and weekly SMS reminders reiterating these guidelines. Although the results of the intervention offer little support for the strategies of providing autonomy support to facilitate autonomous motivation, and the formation of implementation intentions, to elicit pre-drinking behaviour change, the findings are nevertheless important for health practitioners and universities, given the need for pre-drinking-specific interventions to be developed (Pedersen, 2016). At a broader, public health level, however, attempts to reduce the prevalence of pre-drinking may require a range of approaches that work to reduce the incentives associated with engaging in pre-drinking behaviour, and attempts to reduce the alcohol consumed during pre-drinking sessions may benefit from highlighting established alcohol consumption guidelines to reduce of the risks associated with alcohol consumption more generally.

Findings from Chapter II indicate that pre-drinking in Australian undergraduates appears heavily influenced by the cheaper cost of pre-purchased alcohol that can be consumed in pre-drinking sessions, consistent with previous studies (MacLean & Callinan, 2013; Miller et al., 2015). It may therefore be pertinent to investigate how increases in the price of alcohol may reduce pre-drinking alcohol consumption (Anderson, Chisholm, & Fuhr, 2009). Two prominent pricing strategies are to increase the taxation on alcoholic beverages consistent with their alcohol content (known as volumetric taxation), and, to introduce a minimum pricing scheme, that sets a ‘floor’ price that an alcoholic beverage cannot be sold for less than (Fogarty & Chapman, 2013). A challenge to these strategies lies in standardising taxation rates across products, which would substantially increase the cost of certain types of alcoholic beverages¹⁵. Although such regulatory endeavours appear promising, they will likely meet with opposition from customers and industry alike (Fogarty & Chapman, 2013; Tobin, Moodie, & Livingstone, 2011). A ‘middle ground’ may be in balancing regulation between liquor outlets and licensed premises, given that liquor outlets likely make a substantial contribution to alcohol-related harm through discounting and cross-promotion (Wardle, 2015; Wardle & Chang, 2015). Balancing regulation may reduce the price incentive that precipitates pre-drinking, which may reduce its prevalence and subsequent contribution to alcohol-related harm. However, the notable social dynamics offered by pre-drinking may be more difficult to target, meaning harm reduction strategies similar to those implemented in the intervention (i.e., Chapter VI) may be more effective at reducing alcohol-related harm at the individual level.

A central finding of the body of research included in this thesis, is that pre-drinking behaviour appears to be associated with constructs that reflect the impulsive processes related to action (e.g., implicit alcohol identity), and less associated with reflective constructs from motivational and social-cognitive theories (e.g., autonomous motivation, attitudes, intention), with the exception of control. From a dual-systems perspective, these studies indicate that the reflective system is not solely influential in determining pre-drinking behaviour. Given the relationships observed between implicit alcohol identity and outcome variables associated with pre-drinking, the potential malleability of an identity construct may be an important

¹⁵ For example, although cask wine has a higher alcohol percentage, it is taxed lower than ready-to-drink alcoholic beverages (Chalmers, Carragher, Davoren, & O’Brien, 2013; National Health and Medical Research Council, 2009). Pre-drinkers may be aware of this price differential, as many report selecting cask wine to consume during pre-drinking sessions to maximise alcohol intoxication at the lowest price (MacLean & Callinan, 2013).

component in future interventions for pre-drinking and other drug use behaviours (Lindgren, Neighbors, Gasser, Ramirez, & Cvencek, 2016; Lindgren et al., 2015). Attempting to change behaviour through the reflective system (e.g., by attempting to facilitate autonomous motivation, and encourage the formation of *if-then* plans, to reduce pre-drinking alcohol consumption) may not be enough to override more impulsive processes (Frieze, Gianotti, & Knoch, 2015). A number of attempts to modify these processes or train individuals to overcome their influence have been made, with variable success (e.g., Bartsch et al., 2014; Houben, Havermans, Nederkoorn, & Jansen, 2012; Houben, Havermans, & Wiers, 2010; Houben, Nederkoorn, Wiers, & Jansen, 2011). It may be that a combined approach that reduces the influence of the impulsive system (e.g., through evaluative conditioning or training) while promoting motivational and volitional strategies that facilitate the ability to self-regulate behaviour at the reflective level could be more efficacious than either strategy in isolation (e.g., Boffo et al., 2015). An alternative or supplementary strategy may be to address the pre-drinking environment specifically, to reduce the likelihood for individuals to associate the alcohol consumption response to environmental cues, which are likely highly salient in pre-drinking contexts. A range of protective behavioural strategies have been shown to reduce alcohol consumption and the experience of alcohol-related harm among university students (Araas & Adams, 2009), but have yet to be investigated in relation to pre-drinking. Such strategies may be incongruent with the primary aim of most pre-drinkers (i.e., intoxication and continued alcohol consumption beyond the session), however the provision of food, or non-alcoholic beverages at pre-drinking sessions, appear to have some influence on reducing or offsetting excessive alcohol consumption (Benton et al., 2004; Clapp, Shillington, & Segars, 2000; Howard, Griffin, Boekeloo, Lake, & Bellows, 2007).

It may also be important to consider the nature of implicit associations related to alcohol identity, and the factors that foster these associations and influence behaviour. Strack and Deutsch (2004) proposed that impulsive processes stem from repeated stimulus-response associations over time, leading to the formation of strong associative networks. The development of the alcohol identity implicit association test used in the present research, was based on research linking identity with stronger intention-behaviour relationships (Gray, LaPlante, Bannon, Ambady, & Shaffer, 2011; Lindgren et al., 2012). Research into implicit self-concept and morality by Perugini and Leone (2009) suggests that behaviours influenced by implicit traits may start out as requiring input from the reflective system (i.e., controllable behaviours, that require attention); however, over time, the consistency between performing

these behaviours and their outcomes become ingrained and predicted by implicit measures. Adolescence and early adulthood are cognitive developmental periods where individuals' ability to self-regulate behaviour may be susceptible to implicit associations and influences from the impulsive system (Ahmadi et al., 2013; Hofmann, Friese, & Strack, 2009; Thush & Wiers, 2007; Wiers et al., 2007). It is possible that the perceived social and personal benefits attributed to alcohol consumption prior to and upon attending university leads to associations with alcohol and identity that become ingrained over time and may therefore be resistant to change (Borsari & Carey, 2001; Hallett, McManus, et al., 2014; Swanson, Swanson, & Greenwald, 2001).

Given alcohol consumption has been integral in shaping Australian culture (Roche et al., 2009), cultural aspects of drinking may have a pervasive effect on alcohol consumption behaviour from early in life. Research into alcohol-related advertising has shown that children are exposed to alcohol associations from a young age through advertising, which has been shown to influence their alcohol-related cognitions (Jones & Magee, 2011; Stacy, Zogg, Unger, & Dent, 2004). Research has also examined consistent links between alcohol and the sporting industry in Australia, which leads individuals to associate alcohol with social and sporting success (Jones, Phillipson, & Barrie, 2010; O'Brien, Miller, Kolt, Martens, & Webber, 2011; Pettigrew, Johnson, & Daube, 2013). Parental influences on alcohol consumption have also been researched, showing how parents' supply of alcohol to their children, and parental attitudes regarding alcohol consumption, can influence the alcohol-related attitudes and behaviours of their children (Hutchinson, Maloney, Vogl, & Mattick, 2008). These parental influences have been found to influence the alcohol consumption behaviours of students commencing university (Abar, Abar, & Turrisi, 2009; Fairlie, Wood, & Laird, 2012). University orientation periods have been identified as contributing to excessive drinking later in semester, and over the university experience (Riordan, Scarf, & Conner, 2015), perhaps in part due to the increased independence from protective parental influences and "culture of intoxication" inherent to university environments (Hallett, McManus, et al., 2014; Leontini et al., 2015; Strunin et al., 2015). A broader public health approach that attempts to regulate these associative influences at broader societal levels (e.g., limiting alcohol advertising in sport) may be more efficacious than attempting to correct, or shift, biases at the individual level using manipulations developed in the laboratory.

Implications for health behavioural theory

Recently, the utility of the theory of planned behaviour has been the subject of much debate (Hagger, 2015; Sniehotta, Pesseau, & Araujo-Soares, 2014), focusing on its various shortcomings, such as the intention-behaviour gap (Sheeran, 2002). Some of these criticisms can be applied to other theories of social cognition (Rhodes, 2014). The present research contributes to this debate by applying a model based in-part on contemporary theories of motivation and social cognition, and drawing from recent developments based on the integration and incorporation of non-conscious processes in influencing health behaviour. Results of these studies have implications for various theoretical constructs and the posited relationships between them, and reflect the advantages of theoretical integration to form a more comprehensive account of behaviour (Hagger, 2009). For example, the observed associations between autonomous motivation and subjective norm to engage in a deleterious health behaviour; the nature of the perceived behavioural control construct in relation to directly influencing behaviour; and, the relationship between autonomous motivation and implementation intentions in relation to health behavioural goal attainment, have been explored. Each of these will be now outlined in more detail, in turn.

Autonomous motivation and subjective norm. Previously, research drawing from self-determination theory and the theory of planned behaviour has noted strong links between autonomous motivation, attitude, and perceived behavioural control (Hagger & Chatzisarantis, 2009). Links between autonomous motivation and subjective norm are not usually proposed, given the theoretical premise of subjective norm as perceived social influence to engage in a target behaviour, and autonomous motivation as engaging in a target behaviour as it has become internalised, occurring in spite of external contingencies (Ajzen, 1991; Deci & Ryan, 1985b). Amiot et al. (2013) note that self-determination theory research is optimistic in that it focuses on positive human functioning and prosocial behaviours, and these authors therefore sought to apply it to antisocial and harmful behaviours, with a focus on in-group processes (Amiot et al., 2013; Amiot, Sansfaçon, & Louis, 2014; Sansfaçon & Amiot, 2014). Participants who reported being encouraged to engage in a harmful behaviour by a group reported higher self-determination to engage in that behaviour, concluding that group norms can be internalised and enacted for autonomous reasons, potentially reflective satisfaction of the need for relatedness underlying self-determination. It is therefore possible that, based on the relationships observed between these constructs in Chapters II and IV, the influence of autonomous motivation on subjective norm may be explained as the social referents in the latter construct support the individual's autonomy and need for relatedness

(Amiot et al., 2013); whereas the influence of controlled motivation on subjective norm are consistent with external rationales for engaging in behaviour (Neighbors, Larimer, Markman Geisner, et al., 2004). There may therefore be a need to investigate how differing motivational orientations from self-determination theory influence healthy and unhealthy behaviours respectively. This is particularly important, considering techniques from self-determination theory focus on the promotion of autonomous motivation to engage in pro-health behaviours, or to avoid engaging in deleterious health behaviours.

The role of autonomy and message framing (i.e., engaging in behaviour versus reducing it) may have implications for future interventions based on self-determination theory. Research increasingly shows the importance of autonomy when communicating the need for behaviour change, and highlights the potential of an approach tailored to the individual's level of autonomy (Pavey & Sparks, 2008, 2011). Research by Churchill et al. (2015) expanded on previous research by providing a measure of autonomy to participants, then showing them gain- or loss-framed alcohol-related health message, focusing on either short- or long-term outcomes of alcohol consumption. Results indicated that individuals low in autonomy were more receptive to loss-framed messages (i.e., lowering their alcohol consumption), but only for short-term alcohol-related outcomes. Given the potential for framing effects, there may be promise in the promotion of periods of non-drinking than motivational and social cognitive-based attempts to reduce alcohol consumption on drinking occasions (e.g., Conroy, Sparks, & de Visser, 2015).

Perceived behavioural control. Analyses of the integrated behaviour change model in Chapter IV identified routes to perceived behavioural control from controlled and autonomous motivation, respectively. This could pertain to the proposed underlying components of the perceived behavioural construct - *perceived capacity* and *perceived autonomy* (Fishbein & Ajzen, 2011). Fishbein and Ajzen (2011) propose that capacity refers to the ability to engage in the behaviour (e.g., "I have the ability to do X"), and autonomy refers to the ability to engage versus not engage in the behaviour (e.g., "Doing X is up to me"), and that these subcomponents are independent of internal or external factors. From a self-determination theory perspective, it an individual may feel autonomously motivated to reduce their pre-drinking alcohol consumption, possessing both the autonomy and capacity to do so; whereas they may feel controlled motivation to reduce their pre-drinking alcohol consumption, perhaps possessing the capacity to do so but not the autonomy.

Terry and O’Leary (1995) suggest that for non-volitional behaviours, the external environment facilitates the enactment of the behaviour. Individuals with low perceived behavioural control over reducing their pre-drinking alcohol consumption arguably fail to do so as their perceptions of autonomy are consistent with undermining factors in the pre-drinking environment. Implementation intentions were developed as a strategy to link a contextual cue to an intended response, shifting control over behaviour from the individual to the environment (Gollwitzer, 1993). Implementation intentions may therefore capitalise on low perceived autonomy by linking an environmental cue to the intended response. Although there was no effect of the implementation intention content of the intervention on pre-drinking behaviour, this may have been due in part to other factors, such as low compliance with instructions, lack of suitable cues, or the effect of the common components across conditions superseding the approach. More formative research could test for the influence of controlled and autonomous motivation on capacity and autonomy, and moderation of the effect of planning on behaviour through perceived capacity and autonomy.

Motivational and volitional techniques. Chapter VI incorporates some discussion of the theoretical basis for the intervention, in that the autonomy support component may not have been well-suited to a pre-drinking behaviour intervention and that considering other techniques underlying need satisfaction might have made for a more substantial targeting of the motivational phase. Given the findings of Chapters II and IV, that perceived behavioural control appears an important determinant of pre-drinking behaviour, it may be that the provision of autonomy support alone is not adequate in influencing perceptions of control that lead to reductions in pre-drinking alcohol consumption. In the second study of Koestener et al. (2006), a self-efficacy manipulation was used alongside implementation intentions, with findings comparable to those of the previous study combining autonomy support with implementation intentions. Given the conceptual similarities between perceived behavioural control and self-efficacy in that they concern the individual’s perceived ability to perform a behaviour (Ajzen, 2002), it may be that an individual with higher self-efficacy would likely perceive a higher degree of control (i.e., capacity) over behaviour. Therefore, while the intervention targeted autonomy, inclusion of a self-efficacy or structure component (Silva, Marques, & Teixeira, 2014) may satisfy the need for competence and improve the potential of the motivational component of the intervention.

The integration of motivational orientations from self-determination theory and the belief-based evaluations underlying intention in the theory of planned behaviour is based on

the premise that the origins of beliefs guiding intentions are motivational and general in nature, while beliefs and intention regard future behavioural engagements. The inclusion of an implicit measure reflecting the impulsive system, and its subsequent prediction of pre-drinking behaviour, suggests that these impulsive processes may operate at some point between the intentional phase and behavioural engagement, consistent with an action phase approach (Heckhausen, 1991). This suggests that contextual cues (i.e., stimuli) which elicit a response from the impulsive system may influence the enactment of a behaviour that is incongruent with established motivational and intentional energies. Accordingly, Adriaanse and colleagues (2011) suggest that the importance of goal intention strength is easily overlooked in implementation intention interventions, suggesting that these may fail to break habitual or automated behaviours if not sufficiently strong. Therefore, promoting goal intention while limiting pre-drinking facilitating situational cues, may be especially important in determining the success of motivational and volitional strategies to reduce pre-drinking alcohol consumption.

Limitations and future research directions

The programme of research is not without limitations. Firstly, a range of measurement considerations should be taken into account alongside current findings. The theory of planned behaviour constructs were based on previous research on binge drinking (Hagger, Lonsdale, Hein, et al., 2012), yet pre-drinking beliefs were not elicited from participants as recommended by Ajzen (2002). Although binge drinking and pre-drinking could be considered similar behaviours (i.e., the objective of pre-drinking is to become intoxicated by consuming a substantial quantity of alcohol), there may be beliefs specific to pre-drinking that this research did not discover. This may have influenced the relationships between constructs in the motivational sequence, and integrated behaviour-change models to some extent. In addition, there may have been a correspondence issue between the measures of theory of planned behaviour constructs (i.e., attitude, subjective norm, perceived behavioural control, intention) and the measure of pre-drinking alcohol consumption in Chapter IV. Specifically, Ajzen's (2002) Target, Action, Context, and Time guidelines (e.g., "I intend to reduce my alcohol consumption during a pre-drinking session over the next four weeks") were not wholly consistent with the way in which alcohol consumption was measured (e.g., "How many standard drinks did you consume during pre-drinking sessions in the last four weeks?"). However, this approach is not unique in health behavioural research that often attempts to provide accurate measurement of behaviours (i.e., standard drink units), and it

would be difficult to quantify pre-drinking alcohol consumption in the items from theory-based measures. A recent meta-analysis of the theory of planned behaviour applied to alcohol consumption showed substantial differences in the way in which alcohol consumption was measured, with stronger relations observed when the behaviour was more specific (Cooke et al., 2014).

Similarly, the accuracy of participants in reporting alcohol consumption over time periods across studies may not be accurate (Del Boca & Darkes, 2003). As detailed, although participants were provided with a pictorial chart showing the standard drink equivalents of generic alcoholic beverages, the effectiveness of this approach, as well as the extent to which participants attempted to accurately calculate their alcohol consumption behaviour over the periods specified, cannot be determined. A comparison of event-level alcohol and retrospective alcohol consumption shows that individuals tend to report consuming more alcohol during the former than the latter, suggesting self-reported alcohol consumption may be underestimated (Monk, Heim, Qureshi, & Price, 2015). In response to these concerns, recent research has made use of in-situ assessments, such as ecological momentary assessment and event-level analyses, using in-person, SMS, and smartphone methods (Merrill et al., 2013; Miller, 2013; Morgenstern, Kuerbis, & Muench, 2014). These methods can increase the validity of self-report measurement and provide more specific time periods for analyses. Future research should attempt to continue to corroborate self-report with more objective measures to ascertain if the relationships between psychological constructs are consistent.

Other limitations regarding the representativeness of the samples in the studies warrant some discussion. Samples in the included studies were largely comprised of female Western Australian undergraduate students, studying health sciences. Majority-female samples are common in theory of planned behaviour research (Cooke et al., 2014), and although some discrepancies between males and females have been observed in regard to pre-drinking, findings do not appear conclusive, and may be more related to the gender and peer compositions of pre-drinking sessions (Hummer, Napper, Ehret, & LaBrie, 2013; Kuntsche & Labhart, 2013; Ogeil et al., 2016). Research indicates similar patterns of alcohol consumption between university students across national groups (Karam, 2007), and, in the included studies, participant scores on measures of hazardous drinking and average pre-drinking alcohol consumption were broadly consistent with previous findings (Burns et al., 2015; Labhart et al., 2013). In regards to faculty-level differences in alcohol consumption

behaviours, one study found higher incidence of alcohol-related blackouts in health science students than in humanities students (Hallett, Howat, et al., 2014).

Another factor limiting the representativeness of the sample was the slow recruitment progression and sample size for the intervention, potentially due to a likely low level of interest in reducing pre-drinking behaviour among university students (Hallett, McManus, et al., 2014; Leontini et al., 2015). Future research may attempt to increase recruitment through better health promotion avenues, such as recruitment during student orientation, a period associated with increased alcohol consumption (Riordan et al., 2015), or through better integration with university stakeholders (Cronce & Larimer, 2011). Adopting campus alcohol policies that refer students to health services may also increase recruitment (Barnett & Read, 2005).

The integrated behaviour change model was adopted in Chapter IV to consolidated the findings from Chapter II, essentially using the motivational sequence model on which the integrated behaviour change model was based, and including a measure of the impulsive system, due to compounding evidence that implicates the impulsive system in influencing alcohol consumption (e.g., Ahmadi et al., 2013; Friese et al., 2015). While the components of the integrated behaviour-change model have been applied to alcohol consumption (e.g., self-determination theory, theory of planned behaviour), it is important to note that the integrated behaviour-change model was originally formulated based on findings from a body of physical activity research. Further testing of integrated models in other contexts is required to comprehensively determine the extent of similar and different pathways that lead individuals to engage in various health behaviours. It is also important to consider that not all components of the integrated behaviour change framework were tested (e.g., planning, implicit motivation), although, that is not necessarily the intention of its proponents (Ajzen, 1991; Hagger & Chatzisarantis, 2014).

Conclusions

The series of studies included in this thesis aimed to elucidate the motivational, social cognitive, volitional, and implicit constructs involved in engaging in pre-drinking, and reducing pre-drinking alcohol consumption. A series of prospective-correlational studies were designed to test specific hypotheses from an integrated motivational and social cognitive model with respect to the antecedents of pre-drinking. This research was designed to inform the development of an online intervention to reduce pre-drinking alcohol

consumption and associated alcohol-related harm. These formative studies showed some support of posited relationships between constructs in component theories, however intention-behaviour relationships were weak compared to direct effects from control and measures of impulsive processes (i.e., implicit associations). The foundational studies led to the development and testing of an online intervention, using a randomised controlled design, targeting both pre- and post-implementation phases through providing autonomy support and prompting the formation of implementation intentions. The intervention was successful in that all participants reduced their alcohol consumption and experienced lower alcohol-related harm, however no effect of either or both strategies was observed. Future research may attempt to capitalise on the limitations of the present programme of research, potentially by further refining the integrated behaviour-change model, or components that are more relevant to pre-drinking and other alcohol consumption behaviours. Such research may, for example, give greater focus to control (i.e., capacity, autonomy) and implicit factors in relation to pre-drinking. Further applications of integrated theoretical models may do well to include moderators of effects, and conduct finer-grained analyses to ascertain the relationships between these constructs in subsamples and differing contexts.

Bibliography

- Abar, C., Abar, B., & Turrisi, R. (2009). The impact of parental modeling and permissibility on alcohol use and experienced negative drinking consequences in college. *Addictive Behaviors*, 34, 542 - 547. doi:10.1016/j.addbeh.2009.03.019.
- Achtziger, A., & Gollwitzer, P. M. (2008). Motivation and volition in the course of action. In J. Heckhausen & H. Heckhausen (Eds.), *Motivation and Action* (pp. 272-295): Cambridge University Press.
- Adriaanse, M. A., de Ridder, D. T. D., & de Wit, J. B. F. (2009). Finding the critical cue: Implementation intentions to change one's diet work best when tailored to personally relevant reasons for unhealthy eating. *Personality and Social Psychology Bulletin*, 35(1), 60-71. doi:10.1177/0146167208325612
- Adriaanse, M. A., Gollwitzer, P. M., De Ridder, D. T., De Wit, J. B., & Kroese, F. M. (2011). Breaking habits with implementation intentions: A test of underlying processes. *Personality and Social Psychology Bulletin*, 37(4), 502-513. doi:10.1177/0146167211399102
- Ahmadi, A., Pearlson, G. D., Meda, S. A., Dager, A., Potenza, M. N., Rosen, R., . . . Stevens, M. C. (2013). Influence of alcohol use on neural response to Go/No-Go Task in college drinkers. *Neuropsychopharmacology*, 38(11), 2197-2208. doi:10.1038/npp.2013.119
- Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, 50(2), 179-211. doi:10.1016/0749-5978(91)90020-t
- Ajzen, I. (2002). Constructing a TPB questionnaire: Conceptual and methodological considerations. 1-14.
- Ajzen, I. (2011). The theory of planned behaviour: Reactions and reflections. *Psychology & Health*, 26(9), 1113-1127. doi:10.1080/08870446.2011.613995
- Ajzen, I. (2015). The theory of planned behaviour is alive and well, and not ready to retire: a commentary on Sniehotka, Pesseau, and Araújo-Soares. *Health Psychology Review*, 9(2), 131-137. doi:10.1080/17437199.2014.883474

- Alkhalidi, G., Hamilton, F. L., Lau, R., Webster, R., Michie, S., & Murray, E. (2016). The effectiveness of prompts to promote engagement with digital interventions: A systematic review. *Journal of Medical Internet Research*, 18(1).
- Allom, V., Mullan, B., & Hagger, M. S. (2015). Does inhibitory control training improve health behaviour? A meta-analysis. *Health Psychology Review* 10(2), 168-186. doi: 10.1080/17437199.2015.1051078
- Amiot, C. E., Sansfaçon, S., & Louis, W. R. (2013). Investigating the motivations underlying harmful social behaviors and the motivational nature of social norms. *Journal of Applied Social Psychology*, 43(10), 2146-2157. doi:10.1111/jasp.12167
- Amiot, C. E., Sansfaçon, S., & Louis, W. R. (2014). How normative and social identification processes predict self-determination to engage in derogatory behaviours against outgroup hockey fans. *European Journal of Social Psychology*, 44(3), 216-230. doi:10.1002/ejsp.2006
- Anderson, P., Chisholm, D., & Fuhr, D. C. (2009). Effectiveness and cost-effectiveness of policies and programmes to reduce the harm caused by alcohol. *The Lancet*, 373(9682), 2234-2246. doi:10.1016/s0140-6736(09)60744-3
- Araas, T. E., & Adams, T. B. (2009). Protective behavioral strategies and negative alcohol-related consequences in college students. *Journal of Drug Education*, 38(3), 211-224. doi:10.2190/DE.38.3.b
- Armitage, C. J. (2009). Effectiveness of experimenter-provided and self-generated implementation intentions to reduce alcohol consumption in a sample of the general population: a randomized exploratory trial. *Health Psychology*, 28(5), 545.
- Armitage, C. J., & Conner, M. (1999). The theory of planned behaviour: Assessment of predictive validity and perceived control. *British Journal of Social Psychology*, 38(1), 35-54.
- Armitage, C. J., & Conner, M. (2001). Efficacy of the theory of planned behaviour: A meta-analytic review. *The British Journal of Social Psychology*, 40, 471-499.
- Australian Institute of Health and Welfare. (2014). *National Drug Strategy Household Survey detailed report 2013*. (Drug statistics series no. 28. Cat. no. PHE 183.). Retrieved from <http://www.aihw.gov.au/WorkArea/DownloadAsset.aspx?id=60129549848>.

- Bachrach, R. L., Merrill, J. E., Bytschkow, K. M., & Read, J. P. (2012). Development and initial validation of a measure of motives for pregameing in college students. *Addictive Behaviors*, 37(9), 1038-1045. doi:10.1016/j.addbeh.2012.04.013
- Barnett, N. P., & Read, J. P. (2005). Mandatory alcohol intervention for alcohol-abusing college students: A systematic review. *Journal of Substance Abuse Treatment*, 29(2), 147-158. doi:10.1016/j.jsat.2005.05.007
- Barratt, E. S., Patton, J., & Stanford, M. (1975). *Barratt Impulsiveness Scale*. Barratt-Psychiatry Medical Branch, University of Texas.
- Barry, A. E., Stellefson, M. L., Piazza-Gardner, A. K., Chaney, B. H., & Dodd, V. (2013). The impact of pregameing on subsequent blood alcohol concentrations: An event-level analysis. *Addictive Behaviors*, 38(8), 2374-2377. doi:10.1016/j.addbeh.2013.03.014
- Barton, A., & Husk, K. (2012). Controlling pre-loaders: alcohol related violence in an English night time economy. *Drugs and Alcohol Today*, 12(2), 89-97. doi:10.1108/17459261211235119
- Barton, A., & Husk, K. (2014). "I don't really like the pub [...]": reflections on young people and pre-loading alcohol. *Drugs and Alcohol Today*, 14(2), 58-66. doi:10.1108/DAT-12-2013-0055
- Bartsch, A., Mullan, B., & Houben, K. (2014). The effect of non-specific response inhibition training on alcohol consumption: An intervention. *European Health Psychologist*, 16(S), 399.
- Benton, S. L., Schmidt, J. L., Newton, F. B., Shin, K., Benton, S. A., & Newton, D. W. (2004). College student protective strategies and drinking consequences. *Journal of Studies on Alcohol*, 65(1), 115-121. doi:10.15288/jsa.2004.65.115
- Bexley, E., Daroesman, S., Arkoudis, S., & James, R. (2013). University student finances in 2012: a study of the financial circumstances of domestic and international students in Australia's universities. *Centre for the Study of Higher Education*. Retrieved from <http://eric.ed.gov/?id=ED558588>
- Black, N., & Mullan, B. (2015). An intervention to decrease heavy episodic drinking in college students: The effect of executive function training. *Journal of American College Health*, 63(4), 280-284. doi:10.1080/07448481.2014.990969

- Black, N., Mullan, B., & Sharpe, L. (2016). Computer-delivered interventions for reducing alcohol consumption: Meta-analysis and meta-regression using behaviour change techniques and theory. *Health Psychology Review*, 10(3), 341-357. doi:10.1080/17437199.2016.1168268
- Bloomfield, K., Stockwell, T., Gmel, G., & Rehn, N. (2003). International comparisons of alcohol consumption. *Alcohol Research and Health*, 27(1), 95-109.
- Boffo, M., Pronk, T., Wiers, R. W., & Mannarini, S. (2015). Combining cognitive bias modification training with motivational support in alcohol dependent outpatients: study protocol for a randomised controlled trial. *Trials*, 16(1), 63.
- Borsari, B., Boyle, K. E., Hustad, J. T. P., Barnett, N. P., O'Leary Tevyaw, T., & Kahler, C. W. (2007). Drinking before drinking: Pregaming and drinking games in mandated students. *Addictive Behaviors*, 32(11), 2694-2705. doi:10.1016/j.addbeh.2007.05.003
- Borsari, B., & Carey, K. B. (2001). Peer influences on college drinking: A review of the research. *Journal of Substance Abuse*, 13(4), 391-424. doi:10.1016/s0899-3289(01)00098-0
- Borsari, B., & Carey, K. B. (2005). Two brief alcohol interventions for mandated college students. *Psychology of Addictive Behaviors*, 19(3), 296. doi: 10.1037/0893-164X.19.3.296
- Brickell, T. A., Chatzisarantis, N. L., & Pretty, G. M. (2006). Autonomy and control augmenting the validity of the theory of planned behaviour in predicting exercise. *Journal of Health Psychology*, 11(1), 51-63. doi:10.1177/1359105306058847
- Brown, J. M., Miller, W. R., & Lawendowski, L. A. (1999). The self-regulation questionnaire. In L. VandeCreek & T. L. Jackson (Eds). *Innovations in clinical practice: A source book* (pp. 281-292). Sarasota, FL, USA: Professional Resource Exchange.
- Burns, S., Crawford, G., Hallett, J., Jancey, J., Portsmouth, L., Hunt, K., & Longo, J. (2015). Consequences of low risk and hazardous alcohol consumption among university students in Australia and implications for health promotion interventions. *Open Journal of Preventive Medicine*, 5(1), 1-13. doi:10.4236/ojpm.2015.51001

- Bush, K., Kivlahan, D. R., McDonell, M. B., Fihn, S. D., & Bradley, K. A. (1998). The AUDIT alcohol consumption questions (AUDIT-C): an effective brief screening test for problem drinking. *Archives of Internal Medicine*, 158(16), 1789. doi:10.1001/archinte.158.16.1789
- Byrnes, J. M., Cobiac, L. J., Doran, C. M., Vos, T., & Shakeshaft, A. P. (2010). Cost-effectiveness of volumetric alcohol taxation in Australia. *The Medical Journal of Australia*, 192(8), 439-443. doi: 10.1111/j.1465-3362.2011.00309.x
- Carey, K. B., Scott-Sheldon, L. A. J., Carey, M. P., & DeMartini, K. S. (2007). Individual-level interventions to reduce college student drinking: A meta-analytic review. *Addictive Behaviors*, 32(11), 2469-2494. doi:10.1016/j.addbeh.2007.05.004
- Caudwell, K. M., & Hagger, M. S. (2014). Pre-drinking and alcohol-related harm in undergraduates: the influence of explicit motives and implicit alcohol identity. *Journal of Behavioral Medicine*, 37(6), 1252-1262. doi:10.1007/s10865-014-9573-6
- Caudwell, K. M., & Hagger, M. S. (2015). Predicting alcohol pre-drinking in Australian undergraduate students using an integrated theoretical model. *Applied Psychology: Health and Well-Being*, 7(2), 188-213. doi:10.1111/aphw.12044
- Chalmers, J., Carragher, N., Davoren, S., & O'Brien, P. (2013). Real or perceived impediments to minimum pricing of alcohol in Australia: Public opinion, the industry and the law. *International Journal of Drug Policy*, 24(6), 517-523. doi:10.1016/j.drugpo.2013.05.002
- Chatzisarantis, N. L. D., Hagger, M. S., & Smith, B. (2007). Influences of perceived autonomy support on physical activity within the theory of planned behavior. *European Journal of Social Psychology*, 37(5), 934-954.
- Chatzisarantis, N. L. D., Hagger, M. S., Biddle, S. J. H., Smith, B., & Wang, J. C. K. (2003). A meta-analysis of perceived locus of causality in exercise, sport, and physical education contexts. *Journal of Sport and Exercise Psychology*, 25(3), 284-306.
- Chawla, N., Neighbors, C., Logan, D., Lewis, M. A., & Fossos, N. (2009). Perceived approval of friends and parents as mediators of the relationship between self-determination and drinking. *Journal of Studies on Alcohol and Drugs*, 70(1), 92.

- Cheon, S. H., & Reeve, J. (2013). Do the benefits from autonomy-supportive PE teacher training programs endure?: A one-year follow-up investigation. *Psychology of Sport and Exercise, 14*(4), 508-518.
- Cheon, S. H., Reeve, J., & Moon, I. S. (2012). Experimentally based, longitudinally designed, teacher-focused intervention to help physical education teachers be more autonomy supportive toward their students. *Journal of Sport & Exercise Psychology, 34*(3), 365-396. doi: 10.1123/jsep.34.3.365
- Churchill, S., Jessop, D., & Sparks, P. (2008). Impulsive and/or planned behaviour: Can impulsivity contribute to the predictive utility of the theory of planned behaviour? *British Journal of Social Psychology, 47*(4), 631-646.
doi:10.1348/014466608X284434
- Churchill, S., Pavey, L., Jessop, D., & Sparks, P. (2016). Reducing alcohol consumption: the influence of message frame, temporal context and autonomy. *European Health Psychologist, 51*(6), 727-763. doi:10.1093/alcalc/agw033
- Clapp, J. D., Shillington, A. M., & Segars, L. B. (2000). Deconstructing contexts of binge drinking among college students. *The American Journal of Drug and Alcohol Abuse, 26*(1), 139-154. doi:10.1081/ADA-100100596
- Cohen, J. E. (1988). *Statistical Power Analysis for the Behavioral Sciences*. Hillsdale, NJ: Lawrence Erlbaum Associates, Inc.
- Collins, D. J., & Lapsley, H. M. (2008). The avoidable costs of alcohol abuse in Australia and the potential benefits of effective policies to reduce the social costs of alcohol. Canberra, ACT: Commonwealth of Australia Retrieved from <http://www.nationaldrugstrategy.gov.au/internet/drugstrategy/publishing.nsf/Content/mono70-l~mono70-l-exec>.
- Conner, M. (2014). Extending not retiring the theory of planned behaviour: a commentary on Sniehotta, Penseau and Araújo-Soares. *Health Psychology Review, 9*(2), 141-145. doi:10.1080/17437199.2014.899060
- Conner, M., Sandberg, T., McMillan, B., & Higgins, A. (2006). Role of anticipated regret, intentions and intention stability in adolescent smoking initiation. *British Journal of Health Psychology, 11*(1), 85-101. doi: 10.1348/135910705X40997

- Conner, M., & Sparks, P. (2005). Theory of planned behaviour and health behaviour. In M. Conner & P. Norman (Eds.), *Predicting health behaviour* (pp. 170-222). Berkshire, England: McGraw-Hill Education.
- Conroy, D., Sparks, P., & de Visser, R. (2015). Efficacy of a non-drinking mental simulation intervention for reducing student alcohol consumption. *British Journal of Health Psychology*, 20(4), 688-707. doi:10.1111/bjhp.12133
- Cooke, R., Dahdah, M., Norman, P., & French, D. P. (2014). How well does the theory of planned behaviour predict alcohol consumption? A systematic review and meta-analysis. *Health Psychology Review* 10(2), 148-167. doi: 10.1080/17437199.2014.947547
- Cooke, R., Sniehotta, F. F., & Schuz, B. (2007). Predicting binge-drinking behaviour using an extended TPB: Examining the impact of anticipated regret and descriptive norms. *Alcohol and Alcoholism*, 42(2), 84-91. doi:10.1093/alcalc/agl115
- Cooper, M. L. (1994). Motivations for alcohol use among adolescents: Development and validation of a four-factor model. *Psychological Assessment*, 6(2), 117-128.
- Cronce, J. M., & Larimer, M. E. (2011). Individual-focused approaches to the prevention of college student drinking. *Alcohol Research & Health*, 34(2), 210.
- de Visser, R. O., & Birch, J. D. (2012). My cup runneth over: Young people's lack of knowledge of low-risk drinking guidelines. *Drug and Alcohol Review*, 31(2), 206-212. doi:10.1111/j.1465-3362.2011.00371.x
- Deci, E. L., & Ryan, R. M. (1985a). The general causality orientations scale: Self-determination in personality. *Journal of Research in Personality*, 19(2), 109-134.
- Deci, E. L., & Ryan, R. M. (1985b). Intrinsic motivation and self-determination in human behaviour. New York: Plenum.
- Deci, E. L., & Ryan, R. M. (2000). The "what" and "why" of goal pursuits: Human needs and the self-determination of behavior. *Psychological Inquiry*, 11(4), 227-268. doi:10.1207/S15327965PLI1104_01
- Deci, E. L., & Ryan, R. M. (2008). Self-determination theory: A macrotheory of human motivation, development, and health. *Canadian Psychology*, 49(3), 182-185. doi:10.1037/a0012801

- DeJong, W., DeRicco, B., & Schneider, S. K. (2010). Pregaming: An exploratory study of strategic drinking by college students in Pennsylvania. *Journal of American College Health*, 58(4), 307-316. doi:10.1080/07448480903380300
- Del Boca, F. K., & Darkes, J. (2003). The validity of self-reports of alcohol consumption: State of the science and challenges for research. *Addiction*, 98, 1-12. doi:10.1046/j.1359-6357.2003.00586.x
- Dick, D. M., Smith, G., Olausson, P., Mitchell, S. H., Leeman, R. F., O'Malley, S. S., & Sher, K. (2010). Review: Understanding the construct of impulsivity and its relationship to alcohol use disorders. *Addiction Biology*, 15(2), 217-226. doi:10.1111/j.1369-1600.2009.00190.x
- Doran, C. M., & Digiusto, E. (2011). Using taxes to curb drinking: A report card on the Australian government's alcopops tax. *Drug and Alcohol Review*, 30(6), 677-680. doi:10.1111/j.1465-3362.2011.00309.x
- Epton, T., Norman, P., Dadzie, A.-S., Harris, P. R., Webb, T. L., Sheeran, P., . . . Shah, I. (2014). A theory-based online health behaviour intervention for new university students (U@Uni): results from a randomised controlled trial. *BMC Public Health*, 14(1), 563. doi:10.1186/1471-2458-14-563
- Fairlie, A. M., Wood, M. D., & Laird, R. D. (2012). Prospective protective effect of parents on peer influences and college alcohol involvement. *Psychology of Addictive Behaviors*, 26(1), 30-41. doi:10.1037/a0023879
- Fishbach, A., Friedman, R. S., & Kruglanski, A. W. (2003). Leading us not into temptation: Momentary allurements elicit overriding goal activation. *Journal of Personality and Social Psychology*, 84(2), 296. doi:10.1037/0022-3514.84.2.296
- Fishbein, M., & Ajzen, I. (2011). Predicting and changing behavior: The reasoned action approach: Taylor & Francis.
- Fogarty, A. S., & Chapman, S. (2013). What should be done about policy on alcohol pricing and promotions? Australian experts' views of policy priorities: a qualitative interview study. *BMC Public Health*, 13(1), 1-10. doi:10.1186/1471-2458-13-610

- Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research*, 18(1), 39-50.
- Forsyth, A. J. M. (2010). Front, side, and back-loading: patrons' rationales for consuming alcohol purchased off-premises before, during, or after attending nightclubs. *Journal of Substance Use*, 15(1), 31-41. doi:10.3109/14659890902966463
- Fortier, M. S., Duda, J. L., Guerin, E., & Teixeira, P. J. (2012). Promoting physical activity: development and testing of self-determination theory-based interventions. *International Journal of Behavioral Nutrition and Physical Activity*, 9(1), 1-14. doi:10.1186/1479-5868-9-20
- Foster, J. H., & Ferguson, C. (2013). Alcohol 'pre-loading': A review of the literature. *Alcohol and Alcoholism*, 213-226. doi:10.1093/alcalc/agt135
- French, D. P., & Cooke, R. (2012). Using the theory of planned behaviour to understand binge drinking: The importance of beliefs for developing interventions. *British Journal of Health Psychology*, 17(1), 1-17. doi:10.1111/j.2044-8287.2010.02010.x
- Friederichs, S. A., Oenema, A., Bolman, C., Guyaux, J., Van Keulen, H. M., & Lechner, L. (2015). Motivational interviewing in a web-based physical activity intervention: questions and reflections. *Health Promotion International*, 30(3), 803-815. doi:10.1093/heapro/dat069
- Friese, M., Gianotti, L. R. R., & Knoch, D. (2015). The association between implicit alcohol attitudes and drinking behavior is moderated by baseline activation in the lateral prefrontal cortex. *Health Psychology*, 35(8), 837-841. doi:10.1037/hea0000179
- Fry, J. P., & Neff, R. A. (2009). Periodic prompts and reminders in health promotion and health behavior interventions: systematic review. *Journal of Medical Internet Research*, 11(2), e16. doi:10.2196/jmir.1138
- Furtwaengler, N. A., & Visser, R. O. (2013). Lack of international consensus in low-risk drinking guidelines. *Drug and Alcohol Review*, 32(1), 11-18. doi:10.1111/j.1465-3362.2012.00475.x

- Gerrard, M., Gibbons, F. X., Houlihan, A. E., Stock, M. L., & Pomery, E. A. (2008). A dual-process approach to health risk decision making: The prototype willingness model. *Developmental Review, 28*(1), 29-61. doi:10.1016/j.dr.2007.10.001
- Gibbons, F. X., & Gerrard, M. (1995). Predicting young adults' health risk behavior. *Journal of Personality & Social Psychology, 69*(3), 505-517. doi:10.1037/0022-3514.69.3.505
- Gibbons, F. X., Kingsbury, J. H., Gerrard, M., & Wills, T. A. (2011). Two ways of thinking about dual processing: a response to Hofmann, Friese and Wiers (2008). *Health Psychology Review, 5*(2), 158-161. doi:10.1080/17437199.2010.541823
- Gollwitzer, P. M. (1993). Goal achievement: The role of intentions. *European Review of Social Psychology, 4*(1), 141-185. doi:10.1080/14792779343000059
- Gollwitzer, P. M. (1999). Implementation intentions: strong effects of simple plans. *American Psychologist, 54*(7), 493. doi:10.1037/0003-066X.54.7.493
- Gollwitzer, P. M., & Brandstätter, V. (1997). Implementation intentions and effective goal pursuit. *Journal of Personality and Social Psychology, 73*(1), 186. doi:10.1037/0022-3514.73.1.186
- Gollwitzer, P. M., & Sheeran, P. (2006). Implementation intentions and goal achievement: A meta-analysis of effects and processes. *Advances in Experimental Social Psychology, 38*, 69-119. doi:10.1016/S0065-2601(06)38002-1
- Gray, H. M., LaPlante, D. A., Bannon, B. L., Ambady, N., & Shaffer, H. J. (2011). Development and validation of the Alcohol Identity Implicit Associations Test (AI-IAT). *Addictive Behaviors, 36*(9), 919-926. doi:10.1016/j.addbeh.2011.05.003
- Greenwald, A. G., McGhee, D. E., & Schwartz, J. L. (1998). Measuring individual differences in implicit cognition: The implicit association test. *Journal of Personality and Social Psychology, 74*, 1464-1480. doi:10.1037/0022-3514.74.6.1464
- Greenwald, A. G., Nosek, B. A., & Banaji, M. R. (2003). Understanding and using the Implicit Association Test: I. An improved scoring algorithm. *Journal of Personality & Social Psychology, 85*(2), 197-216. doi:10.1037/0022-3514.85.2.197
- Guenther, P. M., Ding, E. L., & Rimm, E. B. (2013). Alcoholic beverage consumption by adults compared to dietary guidelines: Results of the National Health and Nutrition

- Examination Survey, 2009-2010. *Journal of the Academy of Nutrition and Dietetics*, 113(4), 546-550. doi:10.1016/j.jand.2012.12.015
- Gullo, M. J., Dawe, S., Kambouropoulos, N., Staiger, P. K., & Jackson, C. J. (2010). Alcohol expectancies and drinking refusal self-efficacy mediate the association of impulsivity with alcohol misuse. *Alcoholism: Clinical and Experimental Research*, 34(8), 1386-1399. doi:10.1111/j.1530-0277.2010.01222.x
- Hagger, M. S. (2009). Theoretical integration in health psychology: Unifying ideas and complementary explanations. *British Journal of Health Psychology*, 14(2), 189-194. doi:10.1348/135910708x397034
- Hagger, M. S. (2013a). The multiple pathways by which self-control predicts behavior. *Frontiers in Psychology*, 4, 849. doi:10.3389/fpsyg.2013.00849
- Hagger, M. S. (2013b). The opportunity cost model: Automaticity, individual differences, and self-control resources. *Behavioral and Brain Sciences*, 36(06), 687-688. doi:10.1017/S0140525X1300099X
- Hagger, M. S. (2015). Retired or not, the theory of planned behaviour will always be with us. *Health Psychology Review*, 9(2), 125-30. doi:10.1080/17437199.2015.1034470
- Hagger, M. S. (2016). Non-conscious processes and dual-process theories in health psychology. *Health Psychology Review*, 10(4), 375-380. doi:10.1080/17437199.2016.1244647
- Hagger, M. S., Anderson, M., Kyriakaki, M., & Darkings, S. (2007). Aspects of identity and their influence on intentional behavior: Comparing effects for three health behaviors. *Personality and Individual Differences*, 42(2), 355-367. doi:10.1016/j.paid.2006.07.017
- Hagger, M. S., Chan, D. K., Protogerou, C., & Chatzisarantis, N. L. (2016). Using meta-analytic path analysis to test theoretical predictions in health behavior: An illustration based on meta-analyses of the theory of planned behavior. *Preventive Medicine*, 89, 154-161. doi:10.1016/j.ypmed.2016.05.020
- Hagger, M. S., Chatzisarantis, N., Barkoukis, V., Wang, J. C., Hein, V., Pihu, M., . . . Karsai, I. (2007). Cross-cultural generalizability of the theory of planned behavior among

- young people in a physical activity context. *Journal of Sport & Exercise Psychology*, 29(1), 1-19. doi:10.1123/jsep.29.1.2
- Hagger, M. S., & Chatzisarantis, N. L. (2009). Assumptions in research in sport and exercise psychology. *Psychology of Sport and Exercise*, 10(5), 511-519. doi:10.1016/j.psychsport.2009.01.004
- Hagger, M. S., & Chatzisarantis, N. L. D. (2009). Integrating the theory of planned behaviour and self-determination theory in health behaviour: A meta-analysis. *British Journal of Health Psychology*, 14(2), 275-302. doi:10.1348/135910708x373959
- Hagger, M. S., & Chatzisarantis, N. L. D. (2012). Transferring motivation from educational to extramural contexts: A review of the trans-contextual model. *European Journal of Psychology of Education*, 27(2), 195-212.
- Hagger, M. S., & Chatzisarantis, N. L. D. (2014). An integrated behavior change model for physical activity. *Exercise and Sport Sciences Reviews*, 42(2), 62-69. doi: 10.1249/JES.0000000000000008
- Hagger, M. S., & Chatzisarantis, N. L. D. (2015). The trans-contextual model of autonomous motivation in education: Conceptual and empirical issues and meta-analysis. *Review of Educational Research*. doi:10.3102/0034654315585005
- Hagger, M. S., Chatzisarantis, N. L. D., & Biddle, S. J. H. (2002). The influence of autonomous and controlling motives on physical activity intentions within the Theory of Planned Behaviour. *British Journal of Health Psychology*, 7(3), 283-297. doi: 10.1348/135910702760213689
- Hagger, M. S., Chatzisarantis, N. L. D., Culverhouse, T., & Biddle, S. J. H. (2003). The processes by which perceived autonomy support in physical education promotes leisure-time physical activity intentions and behavior: a trans-contextual model. *Journal of Educational Psychology*, 95(4), 784. doi:10.1037/0022-0663.95.4.784
- Hagger, M. S., Chatzisarantis, N. L. D., & Harris, J. (2006). From psychological need satisfaction to intentional behavior: Testing a motivational sequence in two behavioral contexts. *Personality and Social Psychology Bulletin*, 32(2), 131-148. doi:10.1177/0146167205279905

- Hagger, M. S., Chatzisarantis, N. L. D., & Harris, J. (2006). The process by which relative autonomous motivation affects intentional behavior: comparing effects across dieting and exercise behaviors. *Motivation and Emotion*, 30(4), 306-320.
doi:10.1007/s11031-006-9046-5
- Hagger, M. S., Hardcastle, S. J., Chater, A., Mallett, C., Pal, S., & Chatzisarantis, N. L. D. (2014). Autonomous and controlled motivational regulations for multiple health-related behaviors: between- and within-participants analyses. *Health Psychology and Behavioral Medicine*, 565-601. doi:10.1080/21642850.2014.912945
- Hagger, M. S., Lonsdale, A., & Chatzisarantis, N. L. D. (2011). Effectiveness of a brief intervention using mental simulations in reducing alcohol consumption in corporate employees. *Psychology, Health & Medicine*, 16(4), 375-392.
doi:10.1080/13548506.2011.554568
- Hagger, M. S., Lonsdale, A., & Chatzisarantis, N. L. D. (2012). A theory-based intervention to reduce alcohol drinking in excess of guideline limits among undergraduate students. *British Journal of Health Psychology*, 17(1), 18-43. doi:10.1111/j.2044-8287.2010.02011.x
- Hagger, M. S., Lonsdale, A. J., Hein, V., Koka, A., Lintunen, T., Pasi, H., . . . Chatzisarantis, N. L. D. (2012). Predicting alcohol consumption and binge drinking in company employees: An application of planned behaviour and self-determination theories. *British Journal of Health Psychology*, 1-29. doi:10.1111/j.2044-8287.2011.02043.x
- Hagger, M. S., Lonsdale, A. J., Koka, A., Hein, V., Pasi, H., Lintunen, T., & Chatzisarantis, N. L. D. (2012). An intervention to reduce alcohol consumption in undergraduate students using implementation intentions and mental simulations: A cross-national study. *International Journal of Behavioral Medicine*, 19(1), 82-96.
- Hagger, M. S., & Luszczynska, A. (2014). Implementation intention and action planning interventions in health contexts: State of the research and proposals for the way forward. *Applied Psychology: Health and Well-Being*, 6(1), 1-47.
doi:10.1111/aphw.12017
- Hagger, M. S., Luszczynska, A., de Wit, J., Benyamini, Y., Burkert, S., Chamberland, P.-E., . . . French, D. P. (2016). Implementation intention and planning interventions in Health Psychology: Recommendations from the Synergy Expert Group for research

- and practice. *Psychology & Health*, 31(7), 814-839.
doi:10.1080/08870446.2016.1146719
- Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2009). *Multivariate data analysis*. Upper Saddle River, NJ: Prentice Hall.
- Hair, J. F., Hult, G. T. M., Ringle, C., & Sarstedt, M. (2013). *A primer on partial least squares structural equation modeling (PLS-SEM)*. California, USA: SAGE Publications.
- Hair, J. F., Ringle, C. M., & Sarstedt, M. (2011). PLS-SEM: Indeed a Silver Bullet. *Journal of Marketing Theory and Practice*, 19(2), 139-152. doi:10.2753/MTP1069-6679190202
- Hair, J. F., Sarstedt, M., Ringle, C. M., & Mena, J. A. (2012). An assessment of the use of partial least squares structural equation modeling in marketing research. *Journal of the Academy of Marketing Science*, 40(3), 414-433. doi:10.1007/s11747-011-0261-6
- Hallett, J., Howat, P., Maycock, B., McManus, A., Kypri, K., & Dhaliwal, S. (2012). Undergraduate student drinking and related harms at an Australian university: web-based survey of a large random sample. *BMC Public Health*, 12(1), 37. doi:10.1186/1471-2458-12-37
- Hallett, J., Howat, P., McManus, A., Meng, R., Maycock, B., & Kypri, K. (2014). Academic and personal problems among Australian university students who drink at hazardous levels: web-based survey. *Health Promotion Journal of Australia*, 24(3), 170-177. doi:10.1071/HE13094
- Hallett, J., McManus, A., Maycock, B. R., Smith, J., & Howat, P. M. (2014). "Excessive Drinking - an inescapable part of university life?" A focus group study of Australian undergraduates. *Open Journal of Preventive Medicine*, 4(7), 14. doi:10.4236/ojpm.2014.47071
- Hamilton, K., & Hagger, M. S. (2014). The 'health' of health psychology in Australia: Behavioural approaches and interventions. *Australian Psychologist*, 49(2), 63-65. doi:10.1111/ap.12051
- Hardeman, W., Johnston, M., Johnston, D. W., Bonetti, D., Wareham, N. J., & Kinmonth, A. L. (2002). Application of the theory of planned behaviour in behaviour change

- interventions: A systematic review. *Psychology & Health*, 17(2), 123-158.
doi:10.1080/08870440290013644a
- Hasking, P., Shortell, C., & Machalek, M. (2005). University students' knowledge of alcoholic drinks and their perception of alcohol-related harm. *Journal of Drug Education*, 35(2), 95-109. doi:10.2190/9y34-f5xr-aqv5-kel8
- Heckhausen, H. (1991). The rubicon model of action phases. In H. Heckhausen (Ed.), *Motivation and Action*. New York: Springer-Verlag.
- Heckhausen, H., & Gollwitzer, P. M. (1987). Thought contents and cognitive functioning in motivational versus volitional states of mind. *Motivation and Emotion*, 11(2), 101-120. doi:10.1007/BF00992338
- Henges, A. L., & Marczinski, C. A. (2012). Impulsivity and alcohol consumption in young social drinkers. *Addictive behaviors*, 37(2), 217-220.
doi:10.1016/j.addbeh.2011.09.013
- Hofmann, W., Friese, M., & Strack, F. (2009). Impulse and self-control from a dual-systems perspective. *Perspectives on Psychological Science*, 4(2), 162-176.
doi:10.1111/j.1745-6924.2009.01116.x
- Hofmann, W., Friese, M., & Wiers, R. W. (2008). Impulsive versus reflective influences on health behavior: a theoretical framework and empirical review. *Health Psychology Review*, 2(2), 111-137. doi:10.1080/17437190802617668
- Hofmann, W., Friese, M., & Wiers, R. W. (2011). Impulsive processes in the self-regulation of health behaviour: Theoretical and methodological considerations in response to commentaries. *Health Psychology Review*, 5(2), 162-171.
doi:10.1080/17437199.2011.565593
- Hollands, G. J., Marteau, T. M., & Fletcher, P. C. (2016). Non-conscious processes in changing health-related behaviour: a conceptual analysis and framework. *Health Psychology Review*, 1-14. doi:10.1080/17437199.2015.1138093
- Houben, K., Havermans, R. C., Nederkoorn, C., & Jansen, A. (2012). Beer à no-go: learning to stop responding to alcohol cues reduces alcohol intake via reduced affective associations rather than increased response inhibition. *Addiction*, 107(7), 1280-1287.
doi:10.1111/j.1360-0443.2012.03827.x

- Houben, K., Havermans, R. C., & Wiers, R. W. (2010). Learning to dislike alcohol: conditioning negative implicit attitudes toward alcohol and its effect on drinking behavior. *Psychopharmacology*, 211(1), 79-86. doi:10.1007/s00213-010-1872-1
- Houben, K., Nederkoorn, C., Wiers, R. W., & Jansen, A. (2011). Resisting temptation: Decreasing alcohol-related affect and drinking behavior by training response inhibition. *Drug and Alcohol Dependence*, 116(1-3), 132-136. doi:10.1016/j.drugalcdep.2010.12.011
- Houben, K., & Wiers, R. W. (2006). Assessing implicit alcohol associations with the Implicit Association Test: Fact or artifact? *Addictive Behaviors*, 31(8), 1346-1362. doi:10.1016/j.addbeh.2005.10.009
- Houben, K., & Wiers, R. W. (2009). Response inhibition moderates the relationship between implicit associations and drinking behavior. *Alcoholism: Clinical and Experimental Research*, 33(4), 626-633. doi:10.1111/j.1530-0277.2008.00877.x
- Howard, D. E., Griffin, M., Boekeloo, B., Lake, K., & Bellows, D. (2007). Staying safe while consuming alcohol: A qualitative study of the protective strategies and informational needs of college freshmen. *Journal of American College Health*, 56(3), 247-254. doi:10.3200/JACH.56.3.247-254
- Hughes, K., Anderson, Z., Morleo, M., & Bellis, M. A. (2008). Alcohol, nightlife and violence: the relative contributions of drinking before and during nights out to negative health and criminal justice outcomes. *Addiction*, 103(1), 60-65. doi:10.1111/j.1360-0443.2007.02030.x
- Hummer, J. F., Napper, L. E., Ehret, P. E., & LaBrie, J. W. (2013). Event-specific risk and ecological factors associated with prepartying among heavier drinking college students. *Addictive Behaviors*, 38(3), 1620-1628. doi:10.1016/j.addbeh.2012.09.014
- Hutchinson, D., Maloney, E., Vogl, L., & Mattick, R. (2008). Adolescent drinking: The influence of parental attitudes, modeling and alcohol supply. *InPsych*, 30(5), 12-13.
- James, R., Bexley, E., Devlin, M., & Marginson, S. (2007). Australian University Student Finances 2006: Final report of a national survey of students in public universities. Retrieved from <http://dro.deakin.edu.au/>

- Jones, S. C., & Magee, C. A. (2011). Exposure to alcohol advertising and alcohol consumption among Australian adolescents. *Alcohol and Alcoholism*, 46(5), 630-637. doi:10.1093/alcalc/agr080
- Jones, S. C., Phillipson, L., & Barrie, L. (2010). 'Most men drink... especially like when they play sports' – alcohol advertising during sporting broadcasts and the potential impact on child audiences. *Journal of Public Affairs*, 10(1-2), 59-73. doi:10.1002/pa.340
- Kahler, C. W., Hustad, J., Barnett, N. P., Strong, D. R., & Borsari, B. (2008). Validation of the 30-day version of the Brief Young Adult Alcohol Consequences Questionnaire for use in longitudinal studies. *Journal of Studies on Alcohol and Drugs*, 69(4), 611-615.
- Kahler, C. W., Strong, D. R., & Read, J. P. (2005). Toward efficient and comprehensive measurement of the alcohol problems continuum in college students: The Brief Young Adult Alcohol Consequences Questionnaire. *Alcoholism: Clinical and Experimental Research*, 29(7), 1180-1189. doi:10.1097/01.ALC.0000171940.95813.A5
- Karam, E. (2007). Alcohol use among college students: an international perspective. *Current Opinion in Psychiatry*, 20(3), 213. doi:10.1097/YCO.0b013e3280fa836c
- Karam, E., Kypri, K., & Salamoun, M. (2007). Alcohol use among college students: An international perspective. *Current Opinion in Psychiatry*, 20(3), 213-221. doi:10.1097/YCO.0b013e3280fa836c
- Keatley, D. A., Clarke, D. D., & Hagger, M. S. (2011). Investigating the predictive validity of implicit and explicit measures of motivation on condom use, physical activity and healthy eating. *Psychology & Health*, 27(5), 550-569. doi:10.1080/08870446.2011.605451
- Keatley, D. A., Clarke, D. D., & Hagger, M. S. (2012). Investigating the predictive validity of implicit and explicit measures of motivation in problem-solving behavioural tasks. *British Journal of Social Psychology*, 52(5), 510-524. doi:10.1111/j.2044-8309.2012.02107.x
- Keatley, D. A., Clarke, D. D., & Hagger, M. S. (2013a). Investigating the predictive validity of implicit and explicit measures of motivation in problem-solving behavioural tasks.

- British Journal of Social Psychology*, 52(3), 510-524. doi: 10.1111/j.2044-8309.2012.02107.x
- Keatley, D. A., Clarke, D. D., & Hagger, M. S. (2013b). The predictive validity of implicit measures of self-determined motivation across health-related behaviours. *British Journal of Health Psychology*, 18(1), 2-17. doi:10.1111/j.2044-8287.2011.02063.x
- Knee, C. R., & Neighbors, C. (2002). Self-determination, perception of peer pressure, and drinking among college students. *Journal of Applied Social Psychology*, 32(3), 522-543. doi:10.1111/j.1559-1816.2002.tb00228.x
- Kock, N. (2011). Using WarpPLS in e-collaboration studies: Mediating effects, control and second order variables, and algorithm choices. *International Journal of e-Collaboration*, 7(3), 1-13. doi:10.4018/jec.2011070101
- Kock, N. (2012). *WarpPLS 3.0 User Manual* (pp. 55). Retrieved from http://www.scriptwarp.com/warppls/UserManual_WarpPLS_V3.pdf
- Kock, N. (2014). Advanced mediating effects tests, multi-group analyses, and measurement model assessments in PLS-based SEM. *International Journal of e-Collaboration*, 10(1), 1-13. doi:10.4018/ijec.2014010101
- Kock, N. (2015). *WarpPLS 5.0 User Manual* (pp. 55). Texas, USA: ScriptWarp Systems.
- Koestner, R., Horberg, E., Gaudreau, P., Powers, T., Di Dio, P., Bryan, C., . . . Salter, N. (2006). Bolstering implementation plans for the long haul: The benefits of simultaneously boosting self-concordance or self-efficacy. *Personality and Social Psychology Bulletin*, 32(11), 1547-1558. doi:10.1177/0146167206291782
- Koestner, R., Lekes, N., Powers, T. A., & Chicoine, E. (2002). Attaining personal goals: Self-concordance plus implementation intentions equals success. *Journal of Personality & Social Psychology*, 83(1), 231-244.
- Koestner, R., Powers, T. A., Milyavskaya, M., Carbonneau, N., & Hope, N. (2015). Goal internalization and persistence as a function of autonomous and directive forms of goal support. *Journal of Personality*, 83(2), 179-190. doi:10.1111/jopy.12093
- Kuntsche, E., & Labhart, F. (2013). Drinking motives moderate the impact of pre-drinking on heavy drinking on a given evening and related adverse consequences—an event-level study. *Addiction*, 108(10), 1747-1755. doi:10.1111/add.12253

- Kuntsche, E., Otten, R., & Labhart, F. (2015). Identifying risky drinking patterns over the course of Saturday evenings: An event-level study. *Psychology of Addictive Behaviors*, 29, 744-752. doi:10.1037/adb0000057
- Kypri, K., Cronin, M., & Wright, C. S. (2005). Do university students drink more hazardously than their non-student peers? *Addiction*, 100(5), 713-714. doi:10.1111/j.1360-0443.2005.01116.x
- Kypri, K., Hallett, J., Howat, P., McManus, A., Maycock, B., Bowe, S., & Horton, N. J. (2009). Randomized controlled trial of proactive web-based alcohol screening and brief intervention for university students. *Archives of Internal Medicine*, 169(16), 1508-1514. doi:10.1001/archinternmed.2009.249
- Kypri, K., Langley, J. D., Saunders, J. B., & Cashell-Smith, M. L. (2007). Assessment may conceal therapeutic benefit: findings from a randomized controlled trial for hazardous drinking. *Addiction*, 102(1), 62-70 69p. doi:10.1111/j.1360-0443.2006.01632.x
- Kypri, K., Saunders, J. B., & Gallagher, S. J. (2003). Acceptability of various brief intervention approaches for hazardous drinking among university students. *Alcohol and Alcoholism*, 38(6), 626-628. doi:10.1093/alcalc/agg121
- Kypri, K., Saunders, J. B., Williams, S. M., McGee, R. O., Langley, J. D., Cashell-Smith, M. L., & Gallagher, S. J. (2004). Web-based screening and brief intervention for hazardous drinking: a double-blind randomized controlled trial. *Addiction*, 99(11), 1410-1417. doi:10.1111/j.1360-0443.2004.00847.x
- Labhart, F., Graham, K., Wells, S., & Kuntsche, E. (2013). Drinking before going to licensed premises: An event-level analysis of predrinking, alcohol consumption, and adverse outcomes. *Alcoholism: Clinical and Experimental Research*, 37(2), 284-291. doi:10.1111/j.1530-0277.2012.01872.x
- Labhart, F., Wells, S., Graham, K., & Kuntsche, E. (2014). Do individual and situational factors explain the link between predrinking and heavier alcohol consumption? An event-level study of types of beverage consumed and social context. *Alcohol and Alcoholism*, 49(3), 327-335. doi:10.1093/alcalc/agu001

- LaBrie, J. W., Hummer, J., Kenney, S., Lac, A., & Pedersen, E. (2011). Identifying factors that increase the likelihood for alcohol-induced blackouts in the prepartying context. *Substance Use & Misuse*, 46(8), 992-1002. doi:10.3109/10826084.2010.542229
- LaBrie, J. W., Hummer, J. F., Pedersen, E. R., Lac, A., & Chithambo, T. (2012). Measuring college students' motives behind prepartying drinking: Development and validation of the prepartying motivations inventory. *Addictive Behaviors*, 37(8), 962-969. doi:10.1016/j.addbeh.2012.04.003
- LaBrie, J. W., & Pedersen, E. R. (2008). Prepartying Promotes Heightened Risk in the College Environment: An Event-level Report. *Addictive Behaviors*, 33(7), 955-959. doi:10.1016/j.addbeh.2008.02.011
- Larimer, M. E., & Counce, J. M. (2007). Identification, prevention, and treatment revisited: Individual-focused college drinking prevention strategies 1999–2006. *Addictive Behaviors*, 32(11), 2439-2468. doi:10.1016/j.addbeh.2007.05.006
- Laslett, A.-M., Room, R., Ferris, J., Wilkinson, C., Livingston, M., & Mugavin, J. (2011). Surveying the range and magnitude of alcohol's harm to others in Australia. *Addiction*, 106(9), 1603-1611. doi:10.1111/j.1360-0443.2011.03445.x
- Laslett, A.-M., Wilkinson, C., Room, R., Livingston, M., Ferris, J., & Mugavin, J. (2014). Alcohol's harm to others: An overview of Australian work and results so far. *Australasian Epidemiologist*, 21(2), 10.
- Leontini, R., Schofield, T., Lindsay, J., Brown, R., Hepworth, J., & Germov, J. (2015). “Social stuff” and institutional micro-processes: Alcohol use by students in Australian university residential colleges. *Contemporary Drug Problems*, 42(3), 171-187. doi:10.1177/0091450915580970
- Lewis, M. A., Neighbors, C., Oster-Aaland, L., Kirkeby, B. S., & Larimer, M. E. (2007). Indicated prevention for incoming freshmen: Personalized normative feedback and high-risk drinking. *Addictive Behaviors*, 32(11), 2495-2508. doi:10.1016/j.addbeh.2007.06.019
- Lindgren, K. P., Foster, D. W., Westgate, E. C., & Neighbors, C. (2013). Implicit drinking identity: Drinker + me associations predict college student drinking consistently. *Addictive Behaviors*, 38(5), 2163-2166. doi:10.1016/j.addbeh.2013.01.026

- Lindgren, K. P., Neighbors, C., Gasser, M. L., Ramirez, J. J., & Cvencek, D. (2016). A review of implicit and explicit substance self-concept as a predictor of alcohol and tobacco use and misuse. *The American Journal of Drug and Alcohol Abuse*, 1-10. doi:10.1080/00952990.2016.1229324
- Lindgren, K. P., Neighbors, C., Teachman, B. A., Baldwin, S. A., Norris, J., Kaysen, D., . . . Wiers, R. W. (2016). Implicit alcohol associations, especially drinking identity, predict drinking over time. *Health Psychology*, 35(8), 908. doi:10.1037/hea0000396
- Lindgren, K. P., Neighbors, C., Teachman, B. A., Wiers, R. W., Westgate, E., & Greenwald, A. G. (2012). I drink therefore I am: Validating alcohol-related implicit association tests. *Psychology of Addictive Behaviors*, 27(1). doi:10.1016/j.addbeh.2013.01.026
- Lindgren, K. P., Ramirez, J. J., Olin, C. C., & Neighbors, C. (2016). Not the same old thing: Establishing the unique contribution of drinking identity as a predictor of alcohol consumption and problems over time. *Psychology of Addictive Behaviors*, 30(6), 659. doi:10.1037/adb0000195
- Lindgren, K. P., Wiers, R. W., Teachman, B. A., Gasser, M. L., Westgate, E. C., Cousijn, J., . . . Neighbors, C. (2015). Attempted training of alcohol approach and drinking identity associations in US undergraduate drinkers: Null results from two studies. *PloS One*, 10(8), e0134642. doi:10.1371/journal.pone.0134642
- Livingston, M. (2012). Perceptions of low-risk drinking levels among Australians during a period of change in the official drinking guidelines. *Drug and Alcohol Review*, 31(2), 224-230. doi:10.1111/j.1465-3362.2011.00414.x
- Lonsdale, A. J., Hardcastle, S. J., & Hagger, M. S. (2012). A minimum price per unit of alcohol: A focus group study to investigate public opinion concerning UK government proposals to introduce new price controls to curb alcohol consumption. *BMC Public Health*, 12(1), 1-16. doi:10.1186/1471-2458-12-1023
- MacLean, S., & Callinan, S. (2013). "Fourteen dollars for one beer!" Pre-drinking is associated with high-risk drinking among Victorian young adults. *Australian and New Zealand Journal of Public Health*, 37(6), 579-585. doi:10.1111/1753-6405.12138

- Mankarious, E., & Kothe, E. (2015). A meta-analysis of the effects of measuring theory of planned behaviour constructs on behaviour within prospective studies. *Health Psychology Review*, 9(2), 190-204. doi:10.1080/17437199.2014.927722
- Manning, M., Smith, C., & Mazerolle, P. (2013). *The societal costs of alcohol misuse in Australia*. (No. 454). Canberra, ACT: Australian Institute of Criminology Retrieved from http://www.aic.gov.au/media_library/publications/tandi_pdf/tandi454.pdf.
- McEachan, R. R. C., Conner, M., Taylor, N. J., & Lawton, R. J. (2011). Prospective prediction of health-related behaviours with the theory of planned behaviour: A meta-analysis. *Health Psychology Review*, 5(2), 97-144. doi:10.1080/17437199.2010.521684
- McLachlan, S., & Hagger, M. S. (2011). The influence of chronically accessible autonomous and controlling motives on physical activity within an extended theory of planned behavior. *Journal of Applied Social Psychology*, 41(2), 445-470. doi:10.1111/j.1559-1816.2010.00721.x
- Merrill, J. E., Vermont, L. N., Bachrach, R. L., & Read, J. P. (2013). Is the pregame to blame? Event-level associations between pregameing and alcohol-related consequences. *Journal of Studies on Alcohol and Drugs*, 74(5), 757-764. doi:10.15288/jsad.2013.74.757
- Michie, S. (2008). What works and how? Designing more effective interventions needs answers to both questions. *Addiction*, 103(6), 886-887. doi:10.1111/j.1360-0443.2007.02112.x
- Michie, S., & Johnston, M. (2012). Theories and techniques of behaviour change: Developing a cumulative science of behaviour change. *Health Psychology Review*, 6(1), 1-6. doi:10.1080/17437199.2012.654964
- Michie, S., Johnston, M., Francis, J., Hardeman, W., & Eccles, M. (2008). From theory to intervention: mapping theoretically derived behavioural determinants to behaviour change techniques. *Applied Psychology*, 57(4), 660-680. doi:10.1111/j.1464-0597.2008.00341.x

- Miller, P. G. (2013). *Patron Offending and Intoxication in Night-Time Entertainment Districts (POINTED)*. Retrieved from <http://www.ndlrf.gov.au/publications/monographs/monograph-46>
- Miller, P. G., & Droste, N. (2013). Alcohol price considerations on alcohol and illicit drug use in university students. *Journal of Alcoholism and Drug Dependence*, 1(2), 1-4. doi:10.4172/jaldd.1000109
- Miller, P. G., Droste, N., Groot, F., Palmer, D., Tindall, J., Busija, L., . . . Wiggers, J. (2015). Correlates and motives of pre-drinking with intoxication and harm around licensed venues in two cities. *Drug and Alcohol Review*, 35(2), 177-186. doi:10.1111/dar.12274
- Milne, S., Orbell, S., & Sheeran, P. (2002). Combining motivational and volitional interventions to promote exercise participation: Protection motivation theory and implementation intentions. *British Journal of Health Psychology*, 7(2), 163-184. doi:10.1348/135910702169420
- Mohr, D. C., Spring, B., Freedland, K. E., Beckner, V., Arean, P., Hollon, S. D., . . . Kaplan, R. (2009). The selection and design of control conditions for randomized controlled trials of psychological interventions. *Psychotherapy and psychosomatics*, 78(5), 275-284. doi:10.1159/000228248
- Monk, R. L., Heim, D., Qureshi, A., & Price, A. (2015). "I have no clue what I drunk last night" Using smartphone technology to compare in-vivo and retrospective self-reports of alcohol consumption. *PloS one*, 10(5), e0126209. doi:10.1371/journal.pone.0126209
- Moreira, M. T., Oskrochi, R., & Foxcroft, D. R. (2012). Personalised normative feedback for preventing alcohol misuse in university students: Solomon three-group randomised controlled trial. *PloS one*, 7(9), e44120. doi:10.1371/journal.pone.0044120
- Morgenstern, J., Kuerbis, A., & Muench, F. (2014). Ecological momentary assessment and alcohol use disorder treatment. *Alcohol Research: Current Reviews*, 36(1), 101-110.
- Mullan, B., Todd, J., Chatzisarantis, N. L. D., & Hagger, M. S. (2014). Experimental methods in health psychology in Australia: Implications for applied research. *Australian Psychologist*, 49(2), 104-109. doi:10.1111/ap.12046

- Mullan, B., Wong, C., Allom, V., & Pack, S. L. (2011). The role of executive function in bridging the intention-behaviour gap for binge-drinking in university students. *Addictive behaviors*, 36(10), 1023-1026. doi: 10.1016/j.addbeh.2011.05.012
- Murgraff, V., Abraham, C., & McDermott, M. (2007). Reducing Friday alcohol consumption among moderate, women drinkers: Evaluation of a brief evidence-based intervention. *Alcohol and Alcoholism*, 42(1), 37-41. doi:10.1093/alcalc/agl083
- Murgraff, V., White, D., & Phillips, K. (1996). Moderating binge drinking: It is possible to change behaviour if you plan it in advance. *Alcohol and Alcoholism*, 31(6), 577-582. doi:10.1093/oxfordjournals.alcalc.a008193
- National Health and Medical Research Council. (2009). *Australian guidelines to reduce risks from drinking alcohol*. Canberra, ACT: Commonwealth of Australia.
- National Health Service. (2015). Alcohol units and guidelines. Retrieved from <http://www.nhs.uk/change4life/Pages/alcohol-lower-risk-guidelines-units.aspx>
- Neal, D. J., & Simons, J. S. (2007). Inference in regression models of heavily skewed alcohol use data: A comparison of ordinary least squares, generalized linear models, and bootstrap resampling. *Psychology of Addictive Behaviors*, 21(4), 441. doi:10.1037/0893-164X.21.4.441
- Neighbors, C., Larimer, M. E., & Lewis, M. A. (2004). Targeting misperceptions of descriptive drinking norms: efficacy of a computer-delivered personalized normative feedback intervention. *Journal of Consulting and Clinical Psychology*, 72(3), 434. doi:10.1037/0022-006X.72.3.434
- Neighbors, C., Larimer, M. E., Markman Geisner, I., & Knee, C. R. (2004). Feeling controlled and drinking motives among college students: Contingent self-esteem as a mediator. *Self and Identity*, 3(3), 207-224. doi:10.1080/13576500444000029
- Neighbors, C., Lewis, M. A., Bergstrom, R. L., & Larimer, M. E. (2006). Being controlled by normative influences: self-determination as a moderator of a normative feedback alcohol intervention. *Health Psychology*, 25(5), 571. doi:10.1037/0278-6133.25.5.571
- Neighbors, C., Lewis, M. A., Fossos, N., Grossbard, J. R., & Brown, L. (2007). Motivation and risk behaviors: A self-determination perspective. In L. V. Brown (Ed.), *Psychology of Motivation* (pp. 91-113). Happaage, NY: Nova Science.

- Ng, J. Y. Y., Ntoumanis, M., Thøgersen-Ntoumani, C., Deci, E. L., Ryan, R. M., Duda, J. L., & Williams, G. C. (2012). Self-determination theory applied to health contexts. *Perspectives on Psychological Science*, 7(4), 325-340.
doi:10.1177/1745691612447309
- Norman, P., & Conner, M. (2005). The Theory of Planned Behaviour and exercise: Evidence for the mediating and moderating roles of planning on intention-behaviour relationships. *Journal of Sport and Exercise Psychology*, 27(4), 488-504.
doi:10.1123/jsep.27.4.488
- O'Brien, K. S., Miller, P. G., Kolt, G. S., Martens, M. P., & Webber, A. (2011). Alcohol industry and non-alcohol Industry sponsorship of sportspeople and drinking. *Alcohol and Alcoholism*, 46(2), 210-213. doi:10.1093/alcalc/agq095
- O'Rourke, S., Ferris, J., & Devaney, M. (2016). Beyond pre-loading: Understanding the associations between pre-, side-and back-loading drinking behavior and risky drinking. *Addictive behaviors*, 53, 146-154. doi:10.1016/j.addbeh.2015.07.008
- Oei, T. P. S., & Morawska, A. (2004). A cognitive model of binge drinking: The influence of alcohol expectancies and drinking refusal self-efficacy. *Addictive Behaviors*, 29(1), 159-179. doi:10.1016/s0306-4603(03)00076-5
- Ogden, J. (2003). Some problems with social cognition models: A pragmatic and conceptual analysis. *Health Psychology*, 22(4), 424-428. doi:10.1037/0278-6133.22.4.424
- Ogeil, R. P., Lloyd, B., Lam, T., Lenton, S., Burns, L., Aiken, A., . . . Lubman, D. I. (2016). Pre-drinking behavior of young heavy drinkers. *Substance Use & Misuse*, 51(10), 1297-1306. doi:10.3109/10826084.2016.1168443
- Orbell, S., & Sheeran, P. (1998). 'Inclined abstainers': A problem for predicting health-related behaviour. *British Journal of Social Psychology*, 37(2), 151-165.
doi:10.1111/j.2044-8309.1998.tb01162.x
- Orbell, S., & Sheeran, P. (2000). Motivational and volitional processes in action initiation: A field study of the role of implementation intentions. *Journal of Applied Social Psychology*, 30, 780-797. doi:10.1111/j.1559-1816.2000.tb02823.x
- Ostafin, B. D., & Palfai, T. P. (2012). When wanting to change is not enough: automatic appetitive processes moderate the effects of a brief alcohol intervention in hazardous-

- drinking college students. *Addiction Science & Clinical Practice*, 7(1), 1-9.
doi:10.1186/1940-0640-7-25
- Østergaard, J., & Skov, P. R. (2014). Do pre-drinkers consume more alcohol than non-pre-drinkers on an event-specific night out? A cross-national panel mobile survey of young people's drinking in England and Denmark. *Drug and Alcohol Review*, 33(4), 376-384. doi:10.1111/dar.12161
- Ouellette, J. A., & Wood, W. (1998). Habit and intention in everyday life: the multiple processes by which past behavior predicts future behavior. *Psychological bulletin*, 124(1), 54. doi:10.1037/0033-2909.124.1.54
- Papies, E. K. (2016). Health goal priming as a situated intervention tool: how to benefit from nonconscious motivational routes to health behaviour. *Health Psychology Review*, 10(4), 408-424. doi: 10.1080/17437199.2016.1183506
- Paves, A. P., Pedersen, E. R., Hummer, J. F., & LaBrie, J. W. (2012). Prevalence, social contexts, and risks for prepartying among ethnically diverse college students. *Addictive Behaviors*, 37(7), 803-810. doi:10.1016/j.addbeh.2012.03.003
- Pavey, L. J., & Sparks, P. (2008). Threats to autonomy: Motivational responses to risk information. *European Journal of Social Psychology*, 38(5), 852-865.
doi:10.1002/ejsp.477
- Pavey, L. J., & Sparks, P. (2009). Reactance, autonomy and paths to persuasion: Examining perceptions of threats to freedom and informational value. *Motivation and Emotion*, 33(3), 277-290. doi:10.1007/s11031-009-9137-1
- Pavey, L. J., & Sparks, P. (2010). Autonomy and reactions to health-risk information. *Psychology & Health*, 25(7), 855-872. doi:10.1080/08870440902929528
- Pavey, L. J., & Sparks, P. (2011). Autonomy and defensiveness: Experimentally increasing adaptive responses to health-risk information via priming and self-affirmation. *Psychology & Health*, 27(3), 259-276. doi:10.1080/08870446.2011.556251
- Payne, B. K., Govorun, O., & Arbuckle, N. L. (2008). Automatic attitudes and alcohol: Does implicit liking predict drinking? *Cognition & Emotion*, 22(2), 238-271.
doi:10.1080/02699930701357394

- Pedersen, E. R. (2016). Using the solid research base on pregameing to begin intervention development: An epilogue to the special issue on pregameing. *Substance Use & Misuse*, 51, 1067-1073. doi:10.1080/10826084.2016.1187533
- Pedersen, E. R., & LaBrie, J. W. (2007). Partying before the party: Examining prepartying behavior among college students. *Journal of American College Health*, 56(3), 237-245. doi:10.3200/JACH.56.3.237-246
- Pedersen, E. R., LaBrie, J. W., & Kilmer, J. R. (2009). Before you slip into the night, you'll want something to drink: exploring the reasons for prepartying behavior among college student drinkers. *Issues in Mental Health Nursing*, 30(6), 354-363. doi:10.1080/01612840802422623
- Pelletier, L. G., Fortier, M. S., Vallerand, R. J., & Briere, N. M. (2001). Associations among perceived autonomy support, forms of self-regulation, and persistence: A prospective study. *Motivation and Emotion*, 25(4), 279-306. doi:10.1023/A:1014805132406
- Perugini, M. (2005). Predictive models of implicit and explicit attitudes. *The British Journal of Social Psychology*, 44(1), 29-45. doi:10.1348/014466604X23491
- Perugini, M., & Leone, L. (2009). Implicit self-concept and moral action. *Journal of Research in Personality*, 43(5), 747-754.
- Perugini, M., Richetin, J., & Zogmaister, C. (2010). Prediction of behavior *Handbook of implicit social cognition: Measurement, theory, and applications* (Vol. 10, pp. 255-278).
- Pettigrew, S., Johnson, R., & Daube, M. (2013). Introducing and applying a new Australian alcohol advertising code. *Journal of Public Affairs*, 13(1), 72-83. doi:10.1002/pa.1444
- Polizzotto, M. N., Saw, M. M., Tjhung, I., Chua, E. H., & Stockwell, T. R. (2007). Fluid skills: drinking games and alcohol consumption among Australian university students. *Drug and Alcohol Review*, 26(5), 469-475. doi:10.1080/09595230701494374
- Postel, M. G., de Haan, H. A., Ter Huurne, E. D., Becker, E. S., & de Jong, C. A. (2010). Effectiveness of a web-based intervention for problem drinkers and reasons for dropout: randomized controlled trial. *Journal of Medical Internet Research*, 12(4). doi:10.2196/jmir.1642

- Prestwich, A., Ayres, K., & Lawton, R. (2008). Crossing two types of implementation intentions with a protection motivation intervention for the reduction of saturated fat intake: A randomized trial. *Social Science & Medicine*, 67(10), 1550-1558. doi:10.1016/j.socscimed.2008.07.019
- Prestwich, A., Lawton, R., & Conner, M. (2003). The use of implementation intentions and the decision balance sheet in promoting exercise behaviour. *Psychology and health*, 18(6), 707-721. doi:10.1080/08870440310001594493
- Prestwich, A., Perugini, M., & Hurling, R. (2010). Can implementation intentions and text messages promote brisk walking? A randomized trial. *Health Psychology*, 29(1), 40. doi:10.1037/a0016993
- Ramirez, J. J., Dennhardt, A. A., Baldwin, S. A., Murphy, J. G., & Lindgren, K. P. (2016). Alcohol-approach inclinations and drinking identity as predictors of behavioral economic demand for alcohol. *Experimental and Clinical Psychopharmacology*, 24(5). doi:10.1037/pha0000086
- Read, J. P., Merrill, J. E., & Bytschkow, K. (2010). Before the party starts: risk factors and reasons for "pregaming" in college students. *Journal of American College Health*, 58(5), 461-472. doi:10.1080/07448480903540523
- Rebar, A. L., Dimmock, J. A., Jackson, B., Rhodes, R. E., Kates, A., Starling, J., & Vandelanotte, C. (2016). A systematic review of the effects of non-conscious regulatory processes in physical activity. *Health Psychology Review*, 10(4), 395-407. doi:10.1080/17437199.2016.1183505
- Reed, M. B., Clapp, J. D., Weber, M., Trim, R., Lange, J., & Shillington, A. M. (2011). Predictors of partying prior to bar attendance and subsequent BrAC. *Addictive Behaviors*, 36(12), 1341-1343. doi:10.1016/j.addbeh.2011.07.029
- Rhodes, R. E. (2014). Will the new theories (and theoreticians!) please stand up? A commentary on Sniehotta, Penseau and Araújo-Soares. *Health Psychology Review*, 9(2), 156-159. doi:10.1080/17437199.2014.882739
- Rhodes, R. E., & Bruijn, G. J. (2013). How big is the physical activity intention-behaviour gap? A meta-analysis using the action control framework. *British Journal of Health Psychology*, 18(2), 296-309. doi:10.1111/bjhp.12032

- Riordan, B. C., Scarf, D., & Conner, T. S. (2015). Is orientation week a gateway to persistent alcohol use in university students? A preliminary investigation. *Journal of Studies on Alcohol and Drugs*, 76(2), 204-211. doi:10.15288/jsad.2015.76.204
- Roche, A. M., Bywood, P., Freeman, T., Pidd, K., Borlagdan, J., & Trifonoff, A. (2009). *The Social Context of Alcohol Use in Australia*. Adelaide, SA: National Centre for Education and Training on Addiction.
- Room, R., & Livingston, M. (2009). Does it matter where the drinking is, when the object is getting drunk? *Addiction*, 104(1), 10-11. doi:10.1111/j.1360-0443.2008.02423.x
- Rose, P., Smith, S. T., & Segrist, D. J. (2010). Too cheap to chug: frugality as a buffer against college-student drinking. *Journal of Consumer Behaviour*, 9(3), 228-238. doi:10.1002/cb.314
- Ryan, R. M., & Connell, J. P. (1989). Perceived locus of causality and internalization: Examining reasons for acting in two domains. *Journal of Personality & Social Psychology*, 57(5), 749-761. doi:10.1037/0022-3514.57.5.749
- Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist*, 55(1), 68-78. doi:10.1037/0003-066x.55.1.68
- Ryan, R. M., Patrick, H., Deci, E. L., & Williams, G. C. (2008). Facilitating health behaviour change and its maintenance: Interventions based on self-determination theory. *The European Health Psychologist*, 10(1), 2-5.
- Sainsbury, K., Mullan, B., & Sharpe, L. (2013). A randomized controlled trial of an online intervention to improve gluten-free diet adherence in celiac disease. *The American journal of gastroenterology*, 108(5), 811-817. doi:10.1038/ajg.2013.47
- Sansfaçon, S., & Amiot, C. E. (2014). The impact of group norms and behavioral congruence on the internalization of an illegal downloading behavior. *Group Dynamics: Theory, Research, and Practice*, 18(2), 174. doi:10.1037/a0035797
- Schaus, J. F., Sole, M. L., McCoy, T. P., Mullett, N., & O'Brien, M. C. (2009). Alcohol screening and brief intervention in a college student health center: a randomized controlled trial. *Journal of Studies on Alcohol and Drugs*(16), 131. doi:10.15288/jsads.2009.s16.131

- Schwarzer, R. (2013). Life and death of health behaviour theories. *Health Psychology Review*, 8(1), 53-56. doi:10.1080/17437199.2013.810959
- Scott-Sheldon, L. A. J., Carey, K. B., Elliott, J. C., Garey, L., & Carey, M. P. (2014). Efficacy of alcohol interventions for first-year college students: A meta-analytic review of randomized controlled trials. *Journal of consulting and clinical psychology*, 82(2), 177. doi:10.1037/a0035192
- Scott-Sheldon, L. A. J., Carey, K. B., Kaiser, T. S., Knight, J. M., & Carey, M. P. (2016). Alcohol interventions for Greek letter organizations: A systematic review and meta-analysis, 1987 to 2014. *Health Psychology*, 35(7), 670-684. doi:10.1037/hea0000357
- Sheeran, P. (2002). Intention-behavior relations: A conceptual and empirical review. *European Review of Social Psychology*, 12(1), 1-36. doi:10.1080/14792772143000003
- Sheeran, P., Gollwitzer, P. M., & Bargh, J. A. (2013). Nonconscious processes and health. *Health Psychology*, 32(5), 460. doi:10.1037/a0029203
- Sheeran, P., Maki, A., Montanaro, E., Avishai-Yitshak, A., Bryan, A., Klein, W. M. P., . . . Rothman, A. J. (2016). The impact of changing attitudes, norms, and self-efficacy on health-related intentions and behavior: a meta-analysis. *Health Psychology*, 35(11), 1178-1188. doi:10.1037/hea0000387
- Sheeran, P., Norman, P., & Orbell, S. (1999). Evidence that intentions based on attitudes better predict behaviour than intentions based on subjective norms. *European Journal of Social Psychology*, 29(2-3), 403-406. doi:10.1002/(SICI)1099-0992(199903/05)29:2/3<403::AID-EJSP942>3.0.CO;2-A
- Sheldon, K. M., & Elliot, A. J. (1998). Not all personal goals are personal: Comparing autonomous and controlled reasons for goals as predictors of effort and attainment. *Personality and Social Psychology*, 24(5), 546. doi:10.1177/0146167298245010
- Sheldon, K. M., Elliot, A. J., Kim, Y., & Kasser, T. (2001). What is satisfying about satisfying events? Testing 10 candidate psychological needs. *Journal of Personality and Social Psychology*, 80(2), 325. doi:10.1037/0022-3514.80.2.325

- Sheldon, K. M., & Kasser, T. (1998). Pursuing personal goals: Skills enable progress, but not all progress is beneficial. *Personality and Social Psychology Bulletin*, 24(12), 1319-1331. doi:10.1177/01461672982412006
- Skov, S. J., Chikritzhs, T. N., Kypri, K., Miller, P. G., Hall, W. D., Daube, M. M., & Moodie, A. R. (2011). Is the “alcopops” tax working? Probably yes but there is a bigger picture. *Medical Journal of Australia*, 195(2), 84-86.
- Slutske, W. S. (2005). Alcohol use disorders among US college students and their non-college-attending peers. *Archives of General Psychiatry*, 62(3), 321-327. doi:10.1001/archpsyc.62.3.321
- Slutske, W. S., Hunt-Carter, E. E., Nabors-Oberg, R. E., Sher, K. J., Bucholz, K. K., Madden, P. A. F., . . . Heath, A. C. (2004). Do college students drink more than their non-college-attending peers? Evidence from a population-based longitudinal female twin study. *Journal of Abnormal Psychology*, 113(4), 530-540.
- Sniehotta, F. F., Pesseau, J., & Araujo-Soares, V. (2014). Time to retire the theory of planned behaviour. *Health Psychology Review*, 8(1), 1-7. doi:10.1080/17437199.2013.869710
- Sniehotta, F. F., Scholz, U., & Schwarzer, R. (2005). Bridging the intention–behaviour gap: Planning, self-efficacy, and action control in the adoption and maintenance of physical exercise. *Psychology & Health*, 20(2), 143-160. doi:10.1348/014466604X17452
- Sniehotta, F. F., Scholz, U., Schwarzer, R., Fuhrmann, B., Kiwus, U., & Völler, H. (2005). Long-term effects of two psychological interventions on physical exercise and self-regulation following coronary rehabilitation. *International Journal of Behavioral Medicine*, 12(4), 244-255. doi:10.1207/s15327558ijbm1204_5
- Sprott, D. E., Spangenberg, E. R., Block, L. G., Fitzsimons, G. J., Morwitz, V. G., & Williams, P. (2006). The question–behavior effect: What we know and where we go from here. *Social Influence*, 1(2), 128-137. doi:10.1080/15534510600685409
- Stacy, A. W., Zogg, J. B., Unger, J. B., & Dent, C. W. (2004). Exposure to televised alcohol ads and subsequent adolescent alcohol use. *American Journal of Health Behavior*, 28(6), 498-509. doi:10.5993/AJHB.28.6.3

- Strack, F., & Deutsch, R. (2004). Reflective and impulsive determinants of social behavior. *Personality and Social Psychology Review*, 8(3), 220-247.
doi:10.1207/s15327957pspr0803_1
- Strunin, L., Díaz-Martínez, A., Díaz-Martínez, L. R., Kuranz, S., Hernández-Ávila, C., & Fernández-Varela, H. (2015). Changes in alcohol use among first year university students in Mexico. *Substance Use & Misuse*, 50(1), 106-113.
doi:10.3109/10826084.2014.960591
- Su, Y.-I., & Reeve, J. (2011). A meta-analysis of the effectiveness of intervention programs designed to support autonomy. *Educational Psychology Review*, 23(1), 159-188.
doi:10.1007/s10648-010-9142-7
- Swanson, J. E., Swanson, E., & Greenwald, A. G. (2001). Using the Implicit Association Test to investigate attitude-behaviour consistency for stigmatised behaviour. *Cognition & Emotion*, 15(2), 207-230. doi:10.1080/02699930125706
- Tenenhaus, M., Amato, S., & Vinzi, V. E. (2004). *A global goodness-of-fit index for PLS structural equation modelling*. Paper presented at the XLII SIS Scientific Meeting, 2004, Padova, Italy.
- Terry, D. J., & O'Leary, J. E. (1995). The theory of planned behaviour: The effects of perceived behavioural control and self-efficacy. *British Journal of Social Psychology*, 34(2), 199-220. doi:10.1111/j.2044-8309.1995.tb01058.x
- Thush, C., & Wiers, R. W. (2007). Explicit and implicit alcohol-related cognitions and the prediction of future drinking in adolescents. *Addictive Behaviors*, 32(7), 1367-1383.
doi:10.1016/j.addbeh.2006.09.011
- Tobin, C., Moodie, A. R., & Livingstone, C. (2011). A review of public opinion towards alcohol controls in Australia. *BMC Public Health*, 11(58), 1-9. doi:10.1186/1471-2458-11-58
- Todd, J., Kothe, E., Mullan, B., & Monds, L. (2014). Reasoned versus reactive prediction of behaviour: a meta-analysis of the prototype willingness model. *Health Psychology Review*, 1-24. doi:10.1080/17437199.2014.922895

- Todd, J., & Mullan, B. (2011). Using the theory of planned behaviour and prototype willingness model to target binge drinking in female undergraduate university students. *Addictive Behaviors*, 36(10), 980-986. doi:10.1016/j.addbeh.2011.05.010
- Vallerand, R. J., Pelletier, L. G., & Koestner, R. (2008). Reflections on self-determination theory. *Canadian Psychology*, 49(3), 257-262. doi:10.1037/a0012804
- van Lettow, B., de Vries, H., Burdorf, A., & van Empelen, P. (2016). Quantifying the strength of the associations of prototype perceptions with behaviour, behavioural willingness and intentions: A meta-analysis. *Health Psychology Review*, 10(1), 25-43. doi:10.1080/17437199.2014.941997
- Vansteenkiste, M., Simons, J., Lens, W., Sheldon, K. M., & Deci, E. L. (2004). Motivating learning, performance, and persistence: the synergistic effects of intrinsic goal contents and autonomy-supportive contexts. *Journal of Personality and Social Psychology*, 87(2), 246. doi:10.1037/0022-3514.87.2.246
- Verplanken, B., Aarts, H., Knippenberg, A., & Moonen, A. (1998). Habit versus planned behaviour: A field experiment. *British Journal of Social Psychology*, 37(1), 111-128. doi:10.1111/j.2044-8309.1998.tb01160.x
- Vinzi, V. E., Chin, W. W., Henseler, J., & Wang, H. (2010). *Handbook of Partial Least Squares : Concepts, Methods and Applications*. New York, USA: Springer.
- Walters, S. T., Vader, A. M., & Harris, T. R. (2007). A controlled trial of web-based feedback for heavy drinking college students. *Prevention Science*, 8(1), 83-88. doi:10.1007/s11121-006-0059-9
- Wardle, J. L. (2015). Price-based promotions of alcohol: Legislative consistencies and inconsistencies across the Australian retail, entertainment and media sectors. *International Journal of Drug Policy*, 26(5), 522-530. doi:10.1016/j.drugpo.2015.01.013
- Wardle, J. L., & Chang, S. (2015). Cross-promotional alcohol discounting in Australia's grocery sector: a barrier to initiatives to curb excessive alcohol consumption? *Australian and New Zealand Journal of Public Health*, 39(2), 124-128. doi:10.1111/1753-6405.12291

- Webb, E., Ashton, H., Kelly, P., & Kamali, F. (1997). Patterns of alcohol consumption, smoking and illicit drug use in British university students: interfaculty comparisons. *Drug & Alcohol Dependence*, 47(2), 145-153. doi:10.1016/S0376-8716(97)00083-5
- Webb, T. L., Joseph, J., Yardley, L., & Michie, S. (2010). Using the internet to promote health behavior change: A systematic review and meta-analysis of the impact of theoretical basis, use of behavior change techniques, and mode of delivery on efficacy. *Journal of Medical Internet Research*, 12(1). doi:10.2196/jmir.1376
- Webb, T. L., & Sheeran, P. (2006). Does changing behavioral intentions engender behavior change? A meta-analysis of the experimental evidence. *Psychological Bulletin*, 132(2), 249. doi:10.1037/0033-2909.132.2.249
- Webb, T. L., & Sheeran, P. (2007). How do implementation intentions promote goal attainment? A test of component processes. *Journal of Experimental Social Psychology*, 43(2), 295-302. doi:10.1016/j.jesp.2006.02.001
- Wechsler, H., & Nelson, T. F. (2008). What we have learned from the Harvard School of Public Health College Alcohol Study: Focusing attention on college student alcohol consumption and the environmental conditions that promote it. *Journal of Studies on Alcohol and Drugs*, 69(4), 481. doi:10.15288/jsad.2008.69.481
- Weinstein, N. D. (2007). Misleading tests of health behavior theories. *Annals of Behavioral Medicine*, 33(1), 1-10. doi:10.1207/s15324796abm3301_1
- Wells, S., Dumas, T. M., Bernards, S., Kuntsche, E., Labhart, F., & Graham, K. (2015). Predrinking, alcohol use, and breath alcohol concentration: A study of young adult bargoers. *Psychology of Addictive Behaviors*, 29(3), 683-689. doi:10.1037/adb0000065
- Wells, S., Graham, K., & Purcell, J. (2009a). Policy implications of the widespread practice of 'pre-drinking' or 'pre-gaming' before going to public drinking establishments - Are current prevention strategies backfiring? *Addiction*, 104(1), 4-9. doi:10.1111/j.1360-0443.2008.02393.x
- Wells, S., Graham, K., & Purcell, J. (2009b). When the object is to get drunk, pre-drinking matters. *Addiction*, 104(1), 11-12. doi: 10.1111/j.1360-0443.2008.02462.x

- White, A. M., Kraus, C. L., Flom, J. D., Kestenbaum, L. A., Mitchell, J. R., Shah, K., & Swartzwelder, H. S. (2005). College students lack of knowledge of standard drink volumes: Implications for definitions of risky drinking based on survey data. *Alcoholism: Clinical and Experimental Research*, 29(4), 631-638. doi:10.1097/01.alc.0000158836.77407.e6
- White, A. W., Kavanagh, D., Stallman, H., Klein, B., Kay-Lambkin, F., Proudfoot, J., . . . Hines, E. (2010). Online alcohol interventions: A systematic review. *Journal of Medical Internet Research*, 12(5). doi:10.2196/jmir.1479
- Wiers, R. W., Bartholow, B. D., van den Wildenberg, E., Thush, C., Engels, R. C. M. E., Sher, K. J., . . . Stacy, A. W. (2007). Automatic and controlled processes and the development of addictive behaviors in adolescents: a review and a model. *Pharmacology Biochemistry and Behavior*, 86(2), 263-283. doi:10.1016/j.pbb.2006.09.021
- Wiggers, J., Tindall, J., Gillham, K., & Lecathelinais, C. (2012). Targeted regulation of licensed premises in a city entertainment precinct: Impact on assaults, street offences, and emergency department presentations. *Injury Prevention*, 18(Suppl 1), A46-A47. doi:10.1136/injuryprev-2012-040580d.29
- Wilding, S., Conner, M., Sandberg, T., Prestwich, A., Lawton, R., Wood, C., . . . Sheeran, P. (2016). The question-behaviour effect: A theoretical and methodological review and meta-analysis. *European Review of Social Psychology*, 27(1), 196-230. doi:10.1080/10463283.2016.1245940
- Willaby, H. W., Costa, D. S. J., Burns, B. D., MacCann, C., & Roberts, R. D. (2015). Testing complex models with small sample sizes: A historical overview and empirical demonstration of what Partial Least Squares (PLS) can offer differential psychology. *Personality and Individual Differences*, 84, 73-78. doi:10.1016/j.paid.2014.09.008
- Williams, G. C., & Deci, E. L. (2001). Activating patients for smoking cessation through physician autonomy support. *Medical Care*, 39(8), 813-823. doi:10.1097/00005650-200108000-00007
- Williams, G. C., Deci, E. L., & Ryan, R. M. (1998). Building health-care partnerships by supporting autonomy: Promoting maintained behavior change and positive health outcomes. In A. L. Suchman, R. J. Botelho, & P. H. Walker (Eds.), *Partnerships in*

- Healthcare: Transforming Relational Process* (pp. 67-87). New York: University of Rochester Press.
- Williams, G. C., McGregor, H. A., Sharp, D., Levesque, C., Kouides, R. W., Ryan, R. M., & Deci, E. L. (2006). Testing a self-determination theory intervention for motivating tobacco cessation: Supporting autonomy and competence in a clinical trial. *Health Psychology, 25*(1), 91-101. doi:10.1037/0278-6133.25.1.91
- World Health Organization. (2000). *International guide for monitoring alcohol consumption and related harm*. (WHO/MSD/MSB/00.4). Retrieved from http://apps.who.int/iris/bitstream/10665/66529/1/WHO_MSD_MSB_00.4.pdf.
- World Health Organization. (2014). *Global Status Report on Alcohol and Health 2014* (978 92 4 069276 3). Retrieved from http://www.who.int/substance_abuse/publications/global_alcohol_report/en/
- Wright, C. J., Dietze, P. M., Crockett, B., & Lim, M. S. (2016). Participatory development of MIDY (Mobile Intervention for Drinking in Young people). *BMC Public Health, 16*(1), 1-11. doi:10.1186/s12889-016-2876-5
- Young, R. M., Connor, J. P., Ricciardelli, L., & Saunders, J. B. (2006). The role of alcohol expectancy and drinking refusal self-efficacy beliefs in university student drinking. *Alcohol and Alcoholism, 41*(1), 70-75.
- Zamboanga, B., Schwartz, S., Ham, L., Borsari, B., & Van Tyne, K. (2010). Alcohol expectancies, pregameing, drinking games, and hazardous alcohol use in a multiethnic sample of college students. *Cognitive Therapy and Research, 34*(2), 124. doi:10.1007/s10608-009-9234-1

APPENDIX A: STATEMENT OF CONTRIBUTION BY OTHERS

To Whom It May Concern,

Regarding the publication entitled “Predicting alcohol pre-drinking in Australian undergraduate students using an integrated theoretical model”, I, Kimberley Mitchell Caudwell, contributed to the data collection, conducted the analyses, and wrote and revised the manuscript in collaboration with the co-author listed.



Kim M. Caudwell

I, as a Co-Author, endorse that this level of contribution by the candidate indicated above is appropriate.



Martin S. Hagger

Regarding the publication entitled “Pre-drinking and alcohol-related harm in undergraduates: the influence of explicit motives and implicit alcohol identity”. I, Kimberley Mitchell Caudwell, designed the study, collected and analysed the data, and wrote and revised the manuscript in collaboration with the co-author listed.



I, as a Co-Author, endorse that this level of contribution by the candidate indicated above is appropriate.

A handwritten signature in blue ink, appearing to read "Martin Hagger", with a long horizontal flourish extending to the right.

Martin S. Hagger

Regarding the publication entitled “Combining motivational and volitional approaches to reducing excessive alcohol consumption in pre-drinkers: a theory-based intervention protocol”, I, Kimberley Mitchell Caudwell, designed the study in collaboration with the co-authors listed, and wrote and revised the manuscript in collaboration with the co-authors listed.

A handwritten signature in black ink, appearing to read "Kim Caudwell", with a long horizontal flourish extending to the right.

Kim M. Caudwell

I, as a Co-Author, endorse that this level of contribution by the candidate indicated above is appropriate.

A handwritten signature in black ink, appearing to read "Barbara Mullan", with a long horizontal flourish extending to the right.

Barbara A. Mullan

A handwritten signature in blue ink, appearing to read "Martin Hagger", with a long horizontal flourish extending to the right.

Martin S Hagger

APPENDIX B: RIGHTSLINK PRINTABLE LICENCE (CHAPTER II)

The licence to reproduce the publication entitled “Predicting alcohol pre-drinking in Australian undergraduate students using an integrated theoretical model” in Chapter II of this thesis is included on the following pages.

JOHN WILEY AND SONS LICENSE TERMS AND CONDITIONS

Dec 11, 2016

This Agreement between Kim M Caudwell ("You") and John Wiley and Sons ("John Wiley and Sons") consists of your license details and the terms and conditions provided by John Wiley and Sons and Copyright Clearance Center.

License Number	4005711142035
License date	Dec 11, 2016
Licensed Content Publisher	John Wiley and Sons
Licensed Content Publication	Applied Psychology: Health and Well-Being
Licensed Content Title	Predicting Alcohol Pre-Drinking in Australian Undergraduate Students Using an Integrated Theoretical Model
Licensed Content Author	Kim M. Caudwell, Martin S. Hagger
Licensed Content Date	Apr 10, 2015
Licensed Content Pages	26
Type of use	Dissertation/Thesis
Requestor type	Author of this Wiley article
Format	Print
Portion	Full article
Will you be translating?	No
Title of your thesis / dissertation	Alcohol consumption and pre-drinking in Australian undergraduates
Expected completion date	Dec 2016
Expected size (number of pages)	300
Requestor Location	Kim M Caudwell HPBM, School of Psychology Building 401 Kent Street Bentley, WA 6102 Australia Attn: Kim M Caudwell
Publisher Tax ID	EU826007151
Billing Type	Invoice
Billing Address	Kim M Caudwell HPBM, School of Psychology Building 401 Kent Street Bentley, Australia 6102 Attn: Kim M Caudwell
Total	0.00 AUD
Terms and Conditions	

TERMS AND CONDITIONS

This copyrighted material is owned by or exclusively licensed to John Wiley & Sons, Inc. or one of its group companies (each a "Wiley Company") or handled on behalf of a society with which a Wiley Company has exclusive publishing rights in relation to a particular work (collectively "WILEY"). By clicking "accept" in connection with completing this licensing transaction, you agree that the following terms and conditions apply to this transaction

(along with the billing and payment terms and conditions established by the Copyright Clearance Center Inc., ("CCC's Billing and Payment terms and conditions"), at the time that you opened your RightsLink account (these are available at any time at <http://myaccount.copyright.com>).

Terms and Conditions

- The materials you have requested permission to reproduce or reuse (the "Wiley Materials") are protected by copyright.
- You are hereby granted a personal, non-exclusive, non-sub licensable (on a stand-alone basis), non-transferable, worldwide, limited license to reproduce the Wiley Materials for the purpose specified in the licensing process. This license, **and any CONTENT (PDF or image file) purchased as part of your order**, is for a one-time use only and limited to any maximum distribution number specified in the license. The first instance of republication or reuse granted by this license must be completed within two years of the date of the grant of this license (although copies prepared before the end date may be distributed thereafter). The Wiley Materials shall not be used in any other manner or for any other purpose, beyond what is granted in the license. Permission is granted subject to an appropriate acknowledgement given to the author, title of the material/book/journal and the publisher. You shall also duplicate the copyright notice that appears in the Wiley publication in your use of the Wiley Material. Permission is also granted on the understanding that nowhere in the text is a previously published source acknowledged for all or part of this Wiley Material. Any third party content is expressly excluded from this permission.
- With respect to the Wiley Materials, all rights are reserved. Except as expressly granted by the terms of the license, no part of the Wiley Materials may be copied, modified, adapted (except for minor reformatting required by the new Publication), translated, reproduced, transferred or distributed, in any form or by any means, and no derivative works may be made based on the Wiley Materials without the prior permission of the respective copyright owner. **For STM Signatory Publishers clearing permission under the terms of the [STM Permissions Guidelines](#) only, the terms of the license are extended to include subsequent editions and for editions in other languages, provided such editions are for the work as a whole in situ and does not involve the separate exploitation of the permitted figures or extracts**, You may not alter, remove or suppress in any manner any copyright, trademark or other notices displayed by the Wiley Materials. You may not license, rent, sell, loan, lease, pledge, offer as security, transfer or assign the Wiley Materials on a stand-alone basis, or any of the rights granted to you hereunder to any other person.
- The Wiley Materials and all of the intellectual property rights therein shall at all times remain the exclusive property of John Wiley & Sons Inc, the Wiley Companies, or their respective licensors, and your interest therein is only that of having possession of and the right to reproduce the Wiley Materials pursuant to Section 2 herein during the continuance of this Agreement. You agree that you own no right, title or interest in or to the Wiley Materials or any of the intellectual property rights therein. You shall have no rights hereunder other than the license as provided for above in Section 2. No right, license or interest to any trademark, trade name, service mark or other branding ("Marks") of WILEY or its licensors is granted hereunder, and you agree that you shall not assert any such right, license or interest with respect thereto
- NEITHER WILEY NOR ITS LICENSORS MAKES ANY WARRANTY OR REPRESENTATION OF ANY KIND TO YOU OR ANY THIRD PARTY, EXPRESS, IMPLIED OR STATUTORY, WITH RESPECT TO THE MATERIALS OR THE ACCURACY OF ANY INFORMATION CONTAINED IN THE MATERIALS, INCLUDING, WITHOUT LIMITATION, ANY IMPLIED WARRANTY OF MERCHANTABILITY, ACCURACY, SATISFACTORY

QUALITY, FITNESS FOR A PARTICULAR PURPOSE, USABILITY, INTEGRATION OR NON-INFRINGEMENT AND ALL SUCH WARRANTIES ARE HEREBY EXCLUDED BY WILEY AND ITS LICENSORS AND WAIVED BY YOU.

- WILEY shall have the right to terminate this Agreement immediately upon breach of this Agreement by you.
- You shall indemnify, defend and hold harmless WILEY, its Licensors and their respective directors, officers, agents and employees, from and against any actual or threatened claims, demands, causes of action or proceedings arising from any breach of this Agreement by you.
- IN NO EVENT SHALL WILEY OR ITS LICENSORS BE LIABLE TO YOU OR ANY OTHER PARTY OR ANY OTHER PERSON OR ENTITY FOR ANY SPECIAL, CONSEQUENTIAL, INCIDENTAL, INDIRECT, EXEMPLARY OR PUNITIVE DAMAGES, HOWEVER CAUSED, ARISING OUT OF OR IN CONNECTION WITH THE DOWNLOADING, PROVISIONING, VIEWING OR USE OF THE MATERIALS REGARDLESS OF THE FORM OF ACTION, WHETHER FOR BREACH OF CONTRACT, BREACH OF WARRANTY, TORT, NEGLIGENCE, INFRINGEMENT OR OTHERWISE (INCLUDING, WITHOUT LIMITATION, DAMAGES BASED ON LOSS OF PROFITS, DATA, FILES, USE, BUSINESS OPPORTUNITY OR CLAIMS OF THIRD PARTIES), AND WHETHER OR NOT THE PARTY HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. THIS LIMITATION SHALL APPLY NOTWITHSTANDING ANY FAILURE OF ESSENTIAL PURPOSE OF ANY LIMITED REMEDY PROVIDED HEREIN.
- Should any provision of this Agreement be held by a court of competent jurisdiction to be illegal, invalid, or unenforceable, that provision shall be deemed amended to achieve as nearly as possible the same economic effect as the original provision, and the legality, validity and enforceability of the remaining provisions of this Agreement shall not be affected or impaired thereby.
- The failure of either party to enforce any term or condition of this Agreement shall not constitute a waiver of either party's right to enforce each and every term and condition of this Agreement. No breach under this agreement shall be deemed waived or excused by either party unless such waiver or consent is in writing signed by the party granting such waiver or consent. The waiver by or consent of a party to a breach of any provision of this Agreement shall not operate or be construed as a waiver of or consent to any other or subsequent breach by such other party.
- This Agreement may not be assigned (including by operation of law or otherwise) by you without WILEY's prior written consent.
- Any fee required for this permission shall be non-refundable after thirty (30) days from receipt by the CCC.
- These terms and conditions together with CCC's Billing and Payment terms and conditions (which are incorporated herein) form the entire agreement between you and WILEY concerning this licensing transaction and (in the absence of fraud) supersedes all prior agreements and representations of the parties, oral or written. This Agreement may not be amended except in writing signed by both parties. This Agreement shall be binding upon and inure to the benefit of the parties' successors, legal representatives, and authorized assigns.
- In the event of any conflict between your obligations established by these terms and conditions and those established by CCC's Billing and Payment terms and conditions,

these terms and conditions shall prevail.

- WILEY expressly reserves all rights not specifically granted in the combination of (i) the license details provided by you and accepted in the course of this licensing transaction, (ii) these terms and conditions and (iii) CCC's Billing and Payment terms and conditions.
- This Agreement will be void if the Type of Use, Format, Circulation, or Requestor Type was misrepresented during the licensing process.
- This Agreement shall be governed by and construed in accordance with the laws of the State of New York, USA, without regards to such state's conflict of law rules. Any legal action, suit or proceeding arising out of or relating to these Terms and Conditions or the breach thereof shall be instituted in a court of competent jurisdiction in New York County in the State of New York in the United States of America and each party hereby consents and submits to the personal jurisdiction of such court, waives any objection to venue in such court and consents to service of process by registered or certified mail, return receipt requested, at the last known address of such party.

WILEY OPEN ACCESS TERMS AND CONDITIONS

Wiley Publishes Open Access Articles in fully Open Access Journals and in Subscription journals offering Online Open. Although most of the fully Open Access journals publish open access articles under the terms of the Creative Commons Attribution (CC BY) License only, the subscription journals and a few of the Open Access Journals offer a choice of Creative Commons Licenses. The license type is clearly identified on the article.

The Creative Commons Attribution License

The [Creative Commons Attribution License \(CC-BY\)](#) allows users to copy, distribute and transmit an article, adapt the article and make commercial use of the article. The CC-BY license permits commercial and non-

Creative Commons Attribution Non-Commercial License

The [Creative Commons Attribution Non-Commercial \(CC-BY-NC\) License](#) permits use, distribution and reproduction in any medium, provided the original work is properly cited and is not used for commercial purposes.(see below)

Creative Commons Attribution-Non-Commercial-NoDerivs License

The [Creative Commons Attribution Non-Commercial-NoDerivs License](#) (CC-BY-NC-ND) permits use, distribution and reproduction in any medium, provided the original work is properly cited, is not used for commercial purposes and no modifications or adaptations are made. (see below)

Use by commercial "for-profit" organizations

Use of Wiley Open Access articles for commercial, promotional, or marketing purposes requires further explicit permission from Wiley and will be subject to a fee.

Further details can be found on Wiley Online Library

<http://olabout.wiley.com/WileyCDA/Section/id-410895.html>

Other Terms and Conditions:

v1.10 Last updated September 2015

Questions? customercare@copyright.com or +1-855-239-3415 (toll free in the US) or +1-978-646-2777.

APPENDIX C: RIGHTSLINK PRINTABLE LICENCE (CHAPTER III)

The licence to reproduce the publication entitled “Pre-drinking and alcohol-related harm in undergraduates: The influence of explicit motives and implicit alcohol identity” in Chapter III of this thesis is included on the following pages.

**SPRINGER LICENSE
TERMS AND CONDITIONS**

Dec 23, 2016

This Agreement between Kim M Caudwell ("You") and Springer ("Springer") consists of your license details and the terms and conditions provided by Springer and Copyright Clearance Center.

License Number	4005911364813
License date	Dec 11, 2016
Licensed Content Publisher	Springer
Licensed Content Publication	Journal of Behavioral Medicine
Licensed Content Title	Pre-drinking and alcohol-related harm in undergraduates: the influence of explicit motives and implicit alcohol identity
Licensed Content Author	Kim M. Caudwell
Licensed Content Date	Jan 1, 2014
Licensed Content Volume Number	37
Licensed Content Issue Number	6
Type of Use	Thesis/Dissertation
Portion	Full text
Number of copies	3
Author of this Springer article	Yes and you are a contributor of the new work
Order reference number	
Title of your thesis / dissertation	Alcohol consumption and pre-drinking in Australian undergraduates
Expected completion date	Dec 2016
Estimated size(pages)	300
Requestor Location	Kim M Caudwell HPBM, School of Psychology Building 401 Kent Street Bentley, WA 6102 Australia Attn: Kim M Caudwell
Billing Type	Invoice
Billing Address	Kim M Caudwell HPBM, School of Psychology Building 401 Kent Street Bentley, Australia 6102 Attn: Kim M Caudwell
Total	0.00 AUD
Terms and Conditions	

Introduction

The publisher for this copyrighted material is Springer. By clicking "accept" in connection with completing this licensing transaction, you agree that the following terms and conditions apply to this transaction (along with the Billing and Payment terms and conditions

established by Copyright Clearance Center, Inc. ("CCC"), at the time that you opened your Rightslink account and that are available at any time at <http://myaccount.copyright.com>).

Limited License

With reference to your request to reuse material on which Springer controls the copyright, permission is granted for the use indicated in your enquiry under the following conditions:

- Licenses are for one-time use only with a maximum distribution equal to the number stated in your request.

- Springer material represents original material which does not carry references to other sources. If the material in question appears with a credit to another source, this permission is not valid and authorization has to be obtained from the original copyright holder.

- This permission

- is non-exclusive

- is only valid if no personal rights, trademarks, or competitive products are infringed.

- explicitly excludes the right for derivatives.

- Springer does not supply original artwork or content.

- According to the format which you have selected, the following conditions apply accordingly:

- **Print and Electronic:** This License include use in electronic form provided it is password protected, on intranet, or CD-Rom/DVD or E-book/E-journal. It may not be republished in electronic open access.

- **Print:** This License excludes use in electronic form.

- **Electronic:** This License only pertains to use in electronic form provided it is password protected, on intranet, or CD-Rom/DVD or E-book/E-journal. It may not be republished in electronic open access.

For any electronic use not mentioned, please contact Springer at permissions.springer@spi-global.com.

- Although Springer controls the copyright to the material and is entitled to negotiate on rights, this license is only valid subject to courtesy information to the author (address is given in the article/chapter).

- If you are an STM Signatory or your work will be published by an STM Signatory and you are requesting to reuse figures/tables/illustrations or single text extracts, permission is granted according to STM Permissions Guidelines: <http://www.stm-assoc.org/permissions-guidelines/>

For any electronic use not mentioned in the Guidelines, please contact Springer at permissions.springer@spi-global.com. If you request to reuse more content than stipulated in the STM Permissions Guidelines, you will be charged a permission fee for the excess content.

Permission is valid upon payment of the fee as indicated in the licensing process. If permission is granted free of charge on this occasion, that does not prejudice any rights we might have to charge for reproduction of our copyrighted material in the future.

- If your request is for reuse in a Thesis, permission is granted free of charge under the following conditions:

This license is valid for one-time use only for the purpose of defending your thesis and with a maximum of 100 extra copies in paper. If the thesis is going to be published, permission needs to be reobtained.

- includes use in an electronic form, provided it is an author-created version of the thesis on his/her own website and his/her university's repository, including UMI (according to the definition on the Sherpa website: <http://www.sherpa.ac.uk/romeo/>);

- is subject to courtesy information to the co-author or corresponding author.

Geographic Rights: Scope

Licenses may be exercised anywhere in the world.

Altering/Modifying Material: Not Permitted

Figures, tables, and illustrations may be altered minimally to serve your work. You may not alter or modify text in any manner. Abbreviations, additions, deletions and/or any other alterations shall be made only with prior written authorization of the author(s).

Reservation of Rights

Springer reserves all rights not specifically granted in the combination of (i) the license

details provided by you and accepted in the course of this licensing transaction and (ii) these terms and conditions and (iii) CCC's Billing and Payment terms and conditions.

License Contingent on Payment

While you may exercise the rights licensed immediately upon issuance of the license at the end of the licensing process for the transaction, provided that you have disclosed complete and accurate details of your proposed use, no license is finally effective unless and until full payment is received from you (either by Springer or by CCC) as provided in CCC's Billing and Payment terms and conditions. If full payment is not received by the date due, then any license preliminarily granted shall be deemed automatically revoked and shall be void as if never granted. Further, in the event that you breach any of these terms and conditions or any of CCC's Billing and Payment terms and conditions, the license is automatically revoked and shall be void as if never granted. Use of materials as described in a revoked license, as well as any use of the materials beyond the scope of an unrevoked license, may constitute copyright infringement and Springer reserves the right to take any and all action to protect its copyright in the materials.

Copyright Notice: Disclaimer

You must include the following copyright and permission notice in connection with any reproduction of the licensed material:

"Springer book/journal title, chapter/article title, volume, year of publication, page, name(s) of author(s), (original copyright notice as given in the publication in which the material was originally published) "With permission of Springer"

In case of use of a graph or illustration, the caption of the graph or illustration must be included, as it is indicated in the original publication.

Warranties: None

Springer makes no representations or warranties with respect to the licensed material and adopts on its own behalf the limitations and disclaimers established by CCC on its behalf in its Billing and Payment terms and conditions for this licensing transaction.

Indemnity

You hereby indemnify and agree to hold harmless Springer and CCC, and their respective officers, directors, employees and agents, from and against any and all claims arising out of your use of the licensed material other than as specifically authorized pursuant to this license.

No Transfer of License

This license is personal to you and may not be sublicensed, assigned, or transferred by you without Springer's written permission.

No Amendment Except in Writing

This license may not be amended except in a writing signed by both parties (or, in the case of Springer, by CCC on Springer's behalf).

Objection to Contrary Terms

Springer hereby objects to any terms contained in any purchase order, acknowledgment, check endorsement or other writing prepared by you, which terms are inconsistent with these terms and conditions or CCC's Billing and Payment terms and conditions. These terms and conditions, together with CCC's Billing and Payment terms and conditions (which are incorporated herein), comprise the entire agreement between you and Springer (and CCC) concerning this licensing transaction. In the event of any conflict between your obligations established by these terms and conditions and those established by CCC's Billing and Payment terms and conditions, these terms and conditions shall control.

Jurisdiction

All disputes that may arise in connection with this present License, or the breach thereof, shall be settled exclusively by arbitration, to be held in the Federal Republic of Germany, in accordance with German law.

Other conditions:

V 12AUG2015

Questions? customercare@copyright.com or +1-855-239-3415 (toll free in the US) or +1-978-646-2777.

APPENDIX D: LIST OF MEASURES INCLUDED IN CHAPTER IV**Alcohol Identity IAT (Lindgren et al., 2013)**

The following screen captures show each of seven trials in the IAT. Participants are asked to complete a brief word sorting task. The sequence of trials is shown below:

Target compatible practice #1 : 20 trials [Edit](#) [Run](#) [Remove](#)

Me

Not me

First show the following instruction

Put your middle or index fingers on the E and I keys of your keyboard. Words representing the categories at the top will appear one-by-one in the middle of the screen.

When the item belongs to a category on the left, press the 'e' key; when the item belongs to a category on the right, press the 'i' key. For example, if the left category is 'me', and the item is 'mine', the correct response is to press the 'e' key.

Items belong to only one category. If you make an error, a red 'X' will appear – fix the error by pressing the correct key.

This is a timed sorting task. Go as fast as you can, while trying to make as few mistakes as possible. Going too slow or making too many errors will result in an uninterpretable score. This task will take about 5 minutes to complete.

Then display 20 trials, randomly picked from

me my mine self they them theirs other

Attribute practice #2 : 20 trials [Edit](#) [Run](#) [Remove](#)

Drinker

Nondrinker

First show the following instruction

See above, the categories have changed. The items for sorting have changed as well. The rules, however, are the same – when the item belongs to a category on the left, press the 'e' key; when the item belongs to a category on the right, press the 'i' key.

Items belong to only one category. A red 'X' appears after an error – fix the error by pressing the correct key. Go as fast as you can, but try not to make mistakes.

Then display 20 trials, randomly picked from

drinker partier drunk drink nondrinker abstainer sober abstain

Compatible test 1 #3 : 20 trials Edit Run Remove

Me

Not me

Drinker

Nondrinker

First show the following instruction

Now, the four categories you saw separately appear together. Items now belong to one of two groups. For example, if the word is 'mine' or 'drunk', the correct response is pressing the 'e' key. The green and white labels and items may help you to identify the appropriate category.

Use the 'e' and 'i' keys to categorize items into their groups left and right, and fix errors by pressing the correct key.

Then display 20 trials, randomly picked from

me my mine self they them theirs other drinker partier drunk drink nondrinker abstainer sober

abstain

Compatible test 2 #4 : 20 trials Edit Run Remove

Me

Not me

Drinker

Nondrinker

First show the following instruction

Sort the same four categories again. Remember to go as fast as you can while making as few mistakes as possible.

The green and white labels and items may help to identify the appropriate category. Use the 'e' and 'i' keys to categorize items into the four groups left and right, and fix errors by pressing the correct key.

Then display 20 trials, randomly picked from

me my mine self they them theirs other drinker partier drunk drink nondrinker abstainer sober

abstain

Target incompatible practice #5 : 20 trials Edit Run Remove

Not me

Me

First show the following instruction

Notice above, we are back to two categories, but they have switched positions. The concept that was previously on the left is now on the right, and the concept that was on the right is now on the left. Practice this new configuration.

Use the 'e' and 'i' keys to categorise items left and right, and fix errors by pressing the correct key.

Then display 20 trials, randomly picked from

they them theirs other me my mine self

Incompatible test 1 #6 : 20 trials Edit Run Remove

Not me

Me

Drinker

Nondrinker

First show the following instruction

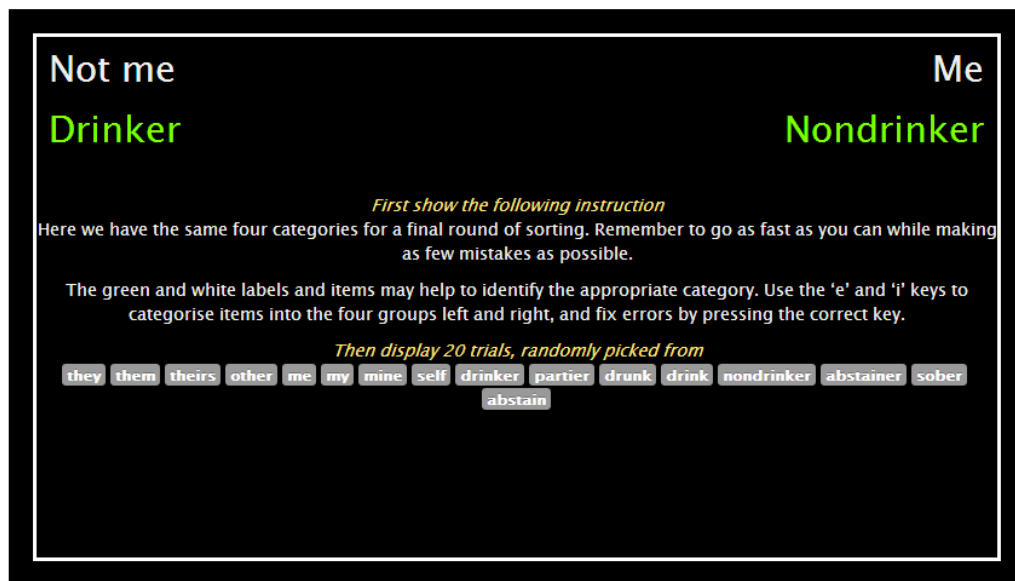
See above, the four categories now appear together in a new configuration. Remember, each item belongs to only one group.

The green and white labels and items may help to identify the appropriate category. Use the 'e' and 'i' keys to categorize items into the four groups left and right, and fix errors by pressing the correct key.

Then display 20 trials, randomly picked from

they them theirs other me my mine self drinker partier drunk drink nondrinker abstainer sober
abstain

Incompatible test 2 #7 : 20 trials Edit Run Remove



Controlled motivation

Response range: 1 (not very true) to 4 (very true)

1. I limit my alcohol consumption during pre-drinking sessions because other people say I should.
2. I limit my alcohol consumption during pre-drinking sessions because my friends/peers/partner say I should.
3. I limit my alcohol consumption during pre-drinking sessions because others will be disappointed if I don't.
4. I get restless and uncomfortable if I don't limit my alcohol consumption during pre-drinking sessions.
5. I feel bad about myself if I do not limit my alcohol consumption during pre-drinking sessions.
6. I limit my alcohol consumption during pre-drinking sessions because I will feel guilty if I do not.

7. I feel ashamed when I do not limit my alcohol consumption during pre-drinking sessions.
8. I feel under pressure from my friends/peers/partner to limit my alcohol consumption during pre-drinking sessions.

Autonomous motivation

Response range: 1 (not very true) to 4 (very true)

1. I limit my alcohol consumption during pre-drinking sessions because I value the benefits.
2. It is pleasurable to limit my alcohol consumption during pre-drinking sessions.
3. It is important to me to limit my alcohol consumption during pre-drinking sessions.
4. I enjoy limiting my alcohol consumption during pre-drinking sessions.
5. I find limiting my alcohol consumption during pre-drinking sessions a pleasurable activity.
6. I get pleasure and satisfaction from limiting my alcohol consumption during pre-drinking sessions.
7. I limit my alcohol consumption during pre-drinking sessions because it is an important part of my life.

Attitude

Response range: 1 (unimportant/not worthwhile/harmful/unenjoyable/bad) to 6 (important/worthwhile/beneficial/enjoyable/good)

1. For me, reducing my alcohol consumption during pre-drinking sessions over the next four weeks would be...

Subjective norm:

Response range: 1 (disagree very strongly) to 6 (agree very strongly)

2. Most people who are important to me would want me to reduce my alcohol consumption during pre-drinking sessions over the next four weeks.
3. Most people I know would approve of me reducing my alcohol consumption during pre-drinking sessions over the next four weeks.
4. Most people whose opinions I value would approve of me reducing my alcohol consumption during pre-drinking sessions over the next four weeks.
5. Most people who are relevant to me would approve of me reducing my alcohol consumption during pre-drinking sessions over the next four weeks.

Perceived behavioural control (A)

Response range: 1 (no control at all) to 6 (complete control)

1. How much personal control do you have over reducing your alcohol consumption during pre-drinking sessions over the next four weeks?

Perceived behavioural control (B)

Response range: 1 (disagree very strongly) to 6 (agree very strongly)

2. It is mostly up to me whether or not I reduce my alcohol consumption during pre-drinking sessions over the next four weeks
3. If I wanted to, I could reduce my alcohol consumption during pre-drinking sessions over the next four weeks.
4. Reducing my alcohol consumption during pre-drinking sessions over the next four weeks is up to me.

Intention

Response range: 1 (disagree very strongly) to 6 (agree very strongly)

1. I intend to reduce my alcohol consumption during pre-drinking sessions over the next four weeks.
2. I plan to reduce my alcohol consumption during pre-drinking sessions over the next four weeks.
3. I will try to reduce my alcohol consumption during pre-drinking sessions over the next four weeks.

Planning¹⁶






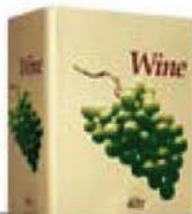
Response range: 1 (disagree very strongly) to 6 (Agree very strongly)









1. I will figure out exactly how I can reduce my alcohol consumption during pre-drinking sessions over the next four weeks.
2. I will make a plan to reduce my alcohol consumption during pre-drinking sessions over the next four weeks.
3. I will come up with a strategy to reduce my alcohol consumption during pre-drinking sessions over the next four weeks.





¹⁶ Planning was measured but not included in the main analyses, due to a high correlation with intention (i.e., $r = .74$) and unsatisfactory crossloadings with intention items.

Pre-drinking alcohol consumption

Participants are shown the following pictorial guide to standard drink equivalents in common beverage containers:

					
1.6 150ml Average Restaurant Serving of Red Wine 13.5% Alc. Vol	8 750ml Bottle of Red Wine 13.5% Alc. Vol	43 4 Litres Cask Red Wine 13.5% Alc. Vol	1.4 150ml Average Restaurant Serving of White Wine 11.5% Alc. Vol	7.5 750ml Bottle of White Wine 12.5% Alc. Vol	39 4 Litres Cask White Wine 12.5% Alc. Vol

							
1 30ml High Strength Spirit Nip 40% Alc. Vol	22 700ml High Strength Bottle of Spirits 40% Alc. Vol	1.2 330ml Full Strength RTD* 5% Alc. Vol	1.8 330ml High Strength RTD* 7% Alc. Vol	1.5 375ml Full Strength Pre-mix Spirits 5% Alc. Vol	1.7 440ml Full Strength Pre-mix Spirits 5% Alc. Vol	2.1 375ml High Strength Pre-mix Spirits 7% Alc. Vol	2.4 440ml High Strength Pre-mix Spirits 7% Alc. Vol

			
1.1 285ml Full Strength 4.8% Alc. Vol	1.6 425ml Full Strength 4.8% Alc. Vol	1.4 375ml Full Strength 4.8% Alc. Vol	34 24 x 375ml Full Strength 4.8% Alc. Vol

“People are known to drink alcohol at home, or at someone else’s house, prior to ‘going out’ to another event (e.g., going to pubs, nightclubs, gigs, or festivals). This is commonly known

as pre-drinking. When we talk about pre-drinking sessions, we mean the occasions in which you have been pre-drinking alcohol prior to attending an event.

How many standard drinks did you consume during pre-drinking sessions in the last four weeks?"

Last week ____ Two weeks ago ____ Three weeks ago ____ Four weeks ago ____

APPENDIX E: ADDITIONAL ANALYSES FOR CHAPTER IV

To ascertain whether the pattern of effects in the integrated behaviour change model were equivalent, standard errors for the beta coefficients were used to derive confidence intervals. The effects were considered equivalent if the confidence intervals ‘overlapped’ (i.e., an estimate could be expected to fit within them).

Table 1. *95% Confidence Intervals for Effects in the Integrated Behaviour Change Model Across Samples.*

Path	B1	95% CI		B2	95% CI		CI Overlap?
AM - Att	.574	.425	.723	.297	.148	.444	Y
AM - SN	.265	.104	.426	.126	-.035	.279	Y
AM - PBC	-.094	-.261	.073	.154	-.013	.305	Y
AM - Int	.397	.242	.552	.166	.011	.317	Y
CM - Att	.041	-.128	.210	.145	-.024	.296	Y
CM - SN	.240	.079	.401	.325	.164	.470	Y
CM - PBC	-.156	-.321	.009	-.373	-.538	-.228	Y
CM - Int	.051	-.118	.220	.170	.001	.321	Y
Att - Int	.370	.213	.527	.406	.249	.549	Y
SN - Int	.042	-.127	.211	.082	-.087	.235	Y
PBC - Int	.026	-.145	.197	.082	-.089	.235	Y
Int - Beh	.132	-.033	.297	-.146	-.311	.005	Y
PBC - Beh	-.241	-.402	-.080	.052	-.109	.207	N
D - Beh	-.080	-.247	.087	.270	.103	.417	N
PB - Beh	.257	.096	.418	.601	.440	.738	N

Note. AM = autonomous motivation; Att = attitude; SN = subjective norm; PBC = perceived behavioural control; Int = intention; CM = controlled motivation; Beh = pre-drinking alcohol consumption (follow-up); D = alcohol identity implicit association test D-score; PB = pre-drinking alcohol consumption (baseline). β_1 95% CI = 95% confidence interval for Western Australian sample effect; β_2 = 95% confidence interval for Queensland sample effect.

As can be seen from Table 1, the pattern of effects was mostly consistent between samples. The confidence intervals for the effects of PBC, D, and PB on behaviour did not overlap between samples, indicating differences in these paths. For two of these effects, the

path was not significant in one sample (i.e., the confidence interval included zero), limiting the extent to which the comparison can be interpreted. The effect of PB on behaviour appears more substantial in the Queensland sample, suggesting a likely difference in the magnitude of this effect.

APPENDIX F: CREATIVE COMMONS AGREEMENT (CHAPTER V)

In regards to the publication entitled “Combining motivational and volitional approaches to reducing excessive alcohol consumption in pre-drinkers: A theory-based intervention protocol” the publisher’s statement regarding copyright for reproducing Open Access content is included on the following pages.

[Skip to main content](#)



[Login to your account](#)

[Search](#)

Search BioMed Central articles

[BMC Public Health](#)

Main menu

- [Home](#)
- [About](#)
- [Articles](#)
- [Submission Guidelines](#)
- [Aims and scope](#)
- [Fees and funding](#)
- [Language editing services](#)
- [Copyright](#)
- [Preparing your manuscript](#)
- [Prepare supporting information](#)
- [Conditions of publication](#)
- [Editorial policies](#)
- [Peer-review policy](#)
- [Manuscript transfers](#)
- [Promoting your publication](#)

Copyright

- Copyright on any open access article in a journal published by BioMed Central is retained by the author(s).
- Authors grant BioMed Central a [license](#) to publish the article and identify itself as the original publisher.
- Authors also grant any third party the right to use the article freely as long as its integrity is maintained and its original authors, citation details and publisher are identified.
- The [Creative Commons Attribution License 4.0](#) formalizes these and other terms and conditions of publishing articles.

In addition to BioMed Central's copyright policy, some journals also follow an Open Data policy and the [Creative Commons CC0 1.0 Public Domain Dedication waiver](#) applies to all published data in these journals. Further information can be found on the individual journals pages.

Where an author is prevented from being the copyright holder (for instance in the case of US government employees or those of Commonwealth governments), minor variations may be required. In such cases the copyright line and license statement in individual articles will be adjusted, for example to state '© 2016 Crown copyright'. Authors requiring a variation of this type should [inform BioMed Central](#) during or immediately after submission of their article.

Exceptions to copyright policy

Our [policy pages](#) provide details concerning copyright and licensing for articles which were previously published under policies that are different from the above. For instance, occasionally BioMed Central may co-

publish articles jointly with other publishers, and different licensing conditions may then apply. In all such cases, however, access to these articles is free from fees or any other access restrictions.

Information specifically regarding permissions and reprints can be found [here](#). Please [contact us](#) if there are questions.

[Submit a manuscript](#)

- [Editorial Board](#)
- [Sign up to article alerts](#)

Follow

- [Follow us on Twitter](#)

BMC Public Health

ISSN: 1471-2458

Contact us

- Editorial email: bmcpublichealth@biomedcentral.com
- Support email: info@biomedcentral.com

Publisher Main Menu

- [Explore journals](#)

- [Get published](#)
- [About BioMed Central](#)

By continuing to use this website, you agree to our [Terms and Conditions](#), [Privacy statement](#) and [Cookies](#) policy.

SPRINGER NATURE

© 2017 BioMed Central Ltd unless otherwise stated. Part of [Springer Nature](#).

APPENDIX G: MEASURES IN CHAPTER VI**Attitude**

Response range: 1 (unimportant/not worthwhile/harmful/unenjoyable/bad) to 6 (important/worthwhile/beneficial/enjoyable/good)

1. For me, reducing my alcohol consumption during pre-drinking sessions over the next four weeks would be...

Subjective norm

Response range: 1 (disagree very strongly) to 6 (agree very strongly)

2. Most people who are important to me (e.g., friends, peers) would want me to reduce my alcohol consumption during pre-drinking sessions over the next four weeks.
3. Most people I know would approve of me reducing my alcohol consumption during pre-drinking sessions over the next four weeks.
4. Most people who are important to me would approve of me reducing my alcohol consumption during pre-drinking sessions over the next four weeks.

Perceived behavioural control (A)

Response range: 1 (no control at all) to 6 (complete control)

1. How much personal control do you have over reducing your alcohol consumption during pre-drinking sessions over the next four weeks?

Perceived behavioural control (B)

Response range: 1 (disagree very strongly) to 6 (agree very strongly)

2. It is mostly up to me whether or not I reduce my alcohol consumption during pre-drinking sessions over the next four weeks
3. If I wanted to, I could reduce my alcohol consumption during pre-drinking sessions over the next four weeks.
4. Reducing my alcohol consumption during pre-drinking sessions over the next four weeks is up to me.

Intention

Response range: 1 (disagree very strongly) to 6 (agree very strongly)

1. I intend to reduce my alcohol consumption during pre-drinking sessions over the next four weeks.
2. I plan to reduce my alcohol consumption during pre-drinking sessions over the next four weeks.
3. I will try to reduce my alcohol consumption during pre-drinking sessions over the next four weeks.

Planning (Planning subscale of the Self-Regulation Questionnaire [Brown, Miller, & Lawendowski, 1999])

Response range: 1 (strongly disagree) to 5 (strongly agree)

1. I have trouble making up my mind about things.
2. I put off making decisions.
3. When it comes to deciding about a change, I feel overwhelmed by the choices.
4. I can come up with lots of ways to change, but it's hard for me to decide which one to use.

5. I have a hard time setting goals for myself.
6. I have trouble making plans to help me reach my goals.
7. Once I have a goal, I can usually plan how to reach it.
8. I usually think before I act.
9. Before making a decision, I consider what I likely to happen if I do one thing or another.

Autonomous motivation and goal self-congruence

Participants are asked the following:

Why might you try to reduce your alcohol consumption during pre-drinking for the following reasons? Please indicate a response below.

Response range: 1 ("not at all for this reason") to 9 ("completely because of this reason")

1. Because somebody else wants you to, or because you'll get something from somebody if you do - you probably wouldn't do this if you didn't get some kind of reward, praise, or approval for it
2. Because you would feel ashamed, guilty, or anxious if you didn't - you feel that you 'ought' to strive for this
3. Because you really believe that it is an important goal to have - you endorse it freely and value it wholeheartedly
4. Because of the fun and enjoyment which it will provide you - the primary reason is simply your interest in the experience itself

Goal progress

Response range: 1 (no progress at all) to 9 (complete progress)

1. How much progress, if any, do you believe you have made on reducing your pre-drinking alcohol consumption over the past four weeks?

Pre-drinking alcohol consumption



Referring to the above guide, how many standard drinks did you consume during pre-drinking sessions in the last four weeks?

Last week ____ Two weeks ago ____ Three weeks ago ____ Four weeks ago ____

Alcohol-related harm (Adapted from the Brief Young Adult Alcohol Consequences Scale; Kahler et al., 2008).

For the following questions, please indicate (i.e., yes or no¹⁷) whether you have experienced the following over the past four weeks.

1. While drinking, I have said or done embarrassing things.
2. I have had a hangover (headache, sick stomach) the morning after I had been drinking.
3. I have felt very sick to my stomach or thrown up after drinking.
4. I often have ended up drinking on nights when I had planned not to drink.
5. I have taken foolish risks when I have been drinking.
6. I have passed out from drinking.
7. I have found that I needed larger amounts of alcohol to feel any effect, or that I could no longer get high or drunk on the amount that used to get me high or drunk.
8. When drinking, I have done impulsive things that I regretted later.
9. I've not been able to remember large stretches of time while drinking heavily.
10. I have driven a car when I knew I had too much to drink to drive safely.
11. I have not gone to work or missed classes at school because of drinking, a hangover, or illness caused by drinking.
12. My drinking has gotten me into sexual situations I later regretted.
13. I have often found it difficult to limit how much I drink.
14. I have become very rude, obnoxious or insulting after drinking.

¹⁷Yes is coded as 1; No is coded as 0; scores are summed to create a total B-YAACQ score.

15. I have woken up in an unexpected place after heavy drinking.
16. I have felt badly about myself because of my drinking.
17. I have had less energy or felt tired because of my drinking.
18. The quality of my work or schoolwork has suffered because of my drinking.
19. I have spent too much time drinking.
20. I have neglected my obligations to family, work, or school because of drinking.
21. My drinking has created problems between myself and my
boyfriend/girlfriend/spouse, parents, or other near relatives.
22. I have been overweight because of drinking.
23. My physical appearance has been harmed by my drinking.
24. I have felt like I needed a drink after I'd gotten up (that is, before breakfast).

APPENDIX G: ITT ANALYSES (CHAPTER VI)

Effects of the intervention on pre-drinking alcohol consumption. No statistically significant three-way interaction effect of time, autonomy support, and implementation intention was observed ($F(1,197) = 2.02, p = .157, \eta_p^2 = .01$). There were also no statistically significant two-way interaction effects of time and autonomy support ($F(1,197) = .08, p = .772, \eta_p^2 < .01$) and time and implementation intention ($F(1,197) = .48, p = .489, \eta_p^2 < .01$) on pre-drinking alcohol consumption. A statistically significant effect of time on pre-drinking alcohol consumption was found, with a large effect size ($F(1,197) = 26.65, p < .001, \eta_p^2 = .12$). Participant pre-drinking alcohol consumption at baseline ($M = 17.76, SE = 1.35$) was significantly different from that at follow-up ($M = 13.95, SE = 1.20$); a difference of 3.81 standard drinks. There were no statistically significant main effects for autonomy support or implementation intention.

Effects of the intervention on alcohol-related harm. We found no statistically significant three-way interaction effect of time, autonomy support, and implementation intention ($F(1,198) = 1.66, p = .199, \eta_p^2 = .01$), and no statistically significant two-way interaction effects of time and autonomy support ($F(1,198) = .05, p = .823, \eta_p^2 < .01$) and time and implementation intention ($F(1,198) = .36, p = .551, \eta_p^2 < .01$), on alcohol-related harm. We also found the statistically significant main effect of time with a large effect size: ($F(1,198) = 80.22, p < .001, \eta_p^2 = .29$). Participant B-YAACQ scores at baseline ($M = 6.62, SE = .29$) were significantly reduced at follow-up ($M = 4.66, SE = .30$), a difference of 1.96. Unlike complete-case analyses, there was no significant main effect for autonomy support ($F(1,198) = 3.31, p = .070, \eta_p^2 = .02$).

**APPENDIX I: EVIDENCE OF ACCEPTANCE OF CONFERENCE
PRESENTATIONS**

Emails regarding the acceptance of presentations listed on page eight of this thesis are included in the following pages.

ASBHM 2014 Conference Auckland New Zealand

Barbara Mullan <>

Mon 28/10/2013 13:30

To: Kim Caudwell <kim.caudwell@postgrad.curtin.edu.au>;

Splendid news

Best regards,
Barbara

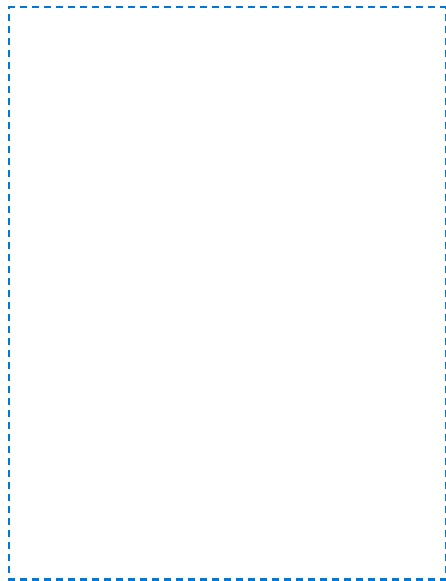
Dr Barbara Mullan

<http://www.psych.usyd.edu.au/lab/health/>

Senior Lecturer
Honours Coordinator
Ph:

Brennan MacCallum 446
School of Psychology
A19 University of Sydney
NSW 2006

Introduction to Health Psychology in Australia 2e



<http://www.pearson.com.au/search-results/product-details/?isbn=9781442547612>

From: []

Sent: Monday, 28 October 2013 2:30 PM

To: Barbara Mullan

Subject: ASBHM 2014 Conference Auckland New Zealand

Dear Barbara,

Re: ASBHM Conference Auckland, New Zealand, 12-14 Feb 2014

On behalf of the ASBHM Conference Program Committee I am pleased to inform you that your abstract titled "PREDICTION AND INTERVENTION FOR RISKY ALCOHOL CONSUMPTION BEHAVIOURS" has been accepted for SYMPOSIUM.

The exact scheduling of your presentation is yet to be finalised, but all conference presentation activities are to be scheduled between 8:30am - 5:30pm from Wednesday 12th February to Friday 14th February 2014. We will notify you by email when the final conference program is available online.

The conference will be held at the Heritage Hotel, Auckland, New Zealand. The registration desk will open early on Wednesday the 12th February 2014. Our first keynote speaker will present at 1:30pm that day, followed by paper sessions and the 'Welcome Reception' hosted by the ASBHM Executive.

REGISTRATION

It's now time to register for the conference. Early bird registration closes at 5pm on 13th December, 2012. Please go to the conference website for registration details. The registration form is now available online ([register now](#)).

Programming for this conference is quite tight, so if, by chance, you have changed your mind or are unable to attend the conference, I would really appreciate it if you could let me know as soon as possible (reply email is fine).

WORKSHOPS

Don't forget we have arranged some very informative and educational workshops to be run by Professor Jo Salmon (Deakin University) and Professor Aleksandra Luszczynska/Professor Martin Hagger. See conference website for more details on the content of the workshops ([click here](#)). Please make sure you indicate on your registration form if you wish to attend one of the workshops (and add these costs into your total registration fee).

CONFERENCE DINNER

The conference dinner will be held on Thursday 13th February. This is an excellent opportunity to meet other conference delegates and our Keynote presenters in an informal setting. Please note that the cost of the conference dinner is not included in the registration fee. When you register for conference, please indicate if you (and perhaps any non-conference attendees) wish to attend the dinner and add these costs to your total registration fee.

TRAVEL AND ACCOMMODATION

The ASBHM website (www.asbhm.org) is being updated regularly with the latest conference organisation information as it comes to hand. There will be information about transport and accommodation options, conference events and the registration details.

ORAL AND 5 MINUTE PRESENTATION GUIDELINES

1. All oral presentations are required to be presented in PowerPoint format (please ensure PowerPoint files are saved in a 97-2003 compatible format).
2. AV equipment (PC computer and data projector) will be available in each presentation room. Please ensure that your presentation(s) are loaded onto the relevant computer, in the relevant room, either at the beginning of the conference, or in one of the breaks on the day of your presentation.
3. Presentations can be loaded by CD or by USB drive. Please note you will NOT be able to run your presentation off your personal computer.
4. Oral presentation: Each presenter will be given 15 minutes to deliver their presentation and 3 minutes for question time. In fairness to other presenters, this timeframe will be strictly enforced.
5. 5 minute presentations: Each presenter will be given 5 minutes to deliver their presentation and 2 minutes for question time. Time limits will be strictly enforced.
6. Your presentation must include original research and should follow a logical progression.

General Tips for Oral/5 minute presenters

1. It's a good idea to practice your presentation to make sure you will not go over time.
2. Keep to one idea per slide.

3. Try to use short phrases rather than long complicated sentences.
4. Use at least an 18 pt font. Think of the poor person in the back row; can they read what is on your slide?
5. Please use standard fonts; this will prevent your slides being reformatted when you load it on to the conference computers.

SYMPOSIUM

1. All presenters within a symposium session should follow the guidelines for oral presentations outlined above

POSTER PRESENTATION GUIDELINES

Your poster should:

1. Provide a clear overview of your research work
2. Be a starting point in order to initiate and stimulate discussions
3. The presenters should remain with their posters during the timetabled session for discussion with conference participants

Structure: A poster has the same structure as a scientific article and includes the following information:

1. Title
2. Authors (with contact details)
3. Abstract
4. Introduction
5. Objectives
6. Methods
7. results
8. Conclusions
9. Tables and figures
10. References

Format: The following characteristics are recommended:

1. Preferably use A0 size (1189 x 841mm), portrait format. Maximum acceptable size is 1400 x 950mm.
2. The font size of the title is at least 80 points, bold face
3. The font size of the section headers is at least 32 points, bold face
4. The font size of the body of the poster (abstract, introduction, objectives, methods, results, and conclusions) is between 18 and 26 points
5. Make sure your title, authors, and affiliated institutions are clearly visible at the top of your presentation. It is common to include your institution logo on the left corner of the poster

Please note: all posters should be printed before the conference. There will not be poster printing facilities on site. We also recommend that you have copies of a handout of your poster with your contact details to give to interested conference attendees.

Finally, if you nominated as an ECR or PG student your presentation will automatically be judged for the Conference prizes- so good luck!

We very much look forward to seeing you at the conference.

Best wishes,

Assoc. Prof. Barbara Mullan

On behalf of the Program Committee: Assoc. Prof. Kerry Sherman, Dr. Carina Chan

==

APSAD 2014 - Abstract Notification

Kim Vanderslik <>

Wed 20/08/2014 14:26

To: Kim Caudwell <kim.caudwell@postgrad.curtin.edu.au>;

 1 attachments (19 KB)

560U49KD.html;

20 August 2014

Ref: 36

Mr Kim Caudwell
PhD Student
Curtin University
Building 401
Kent Street
Building 401
BENTLEY Å 6102
--- PLEASE SELECT ---

**Australasian Professional Society on Alcohol and Other Drugs Scientific Conference
9 - 12 November 2014
Adelaide Convention Centre**

Dear Mr Caudwell,

On behalf of the Scientific Program Committee, we are pleased to confirm that the following abstract has been accepted for a poster presentation at the APSAD Conference 2014 to be held at the Adelaide Convention Centre from 9 - 12 November 2014.

Your session details will be confirmed in the coming weeks once the program has been finalised.

Conference Papers

Paper Details	
Title:	Predicting Pre-drinking Alcohol Consumption using a Dual-systems Approach
Paper Number:	27.00
Paper Status:	Poster Accepted
Presentation Type:	Poster Presentation
Authors:	Kim Caudwell Martin Hagger

Registration

Please be advised that all presenters are required to register and pay to attend the conference by **Friday 29 August 2014**. If you have not already done so, registration and payment can be completed online using your personalised registration link below. Please follow the instructions below to ensure your registration is directly linked to your abstract submission.

To Register

- 1) [Click here](#) to register
- 2) Under 'Author Registration' enter your access key **48N8X8FHK** in box 1 titled 'I am a Speaker'.

Please note you will also be responsible for your own accommodation and travel expenses relating to the Conference.

The support you have shown for the Conference is greatly appreciated and we look forward to your involvement in the program.

If you have any queries, please do not hesitate to contact the Conference Managers on tel: +61 2 9265 0700 or email: apsadconference@arinex.com.au.

We look forward to welcoming you in Adelaide!

Yours sincerely,

APSAD 2014 Conference Managers

Managed by **Arinex** Pty Ltd

Level 10, 51 Druitt Street

Sydney NSW 2001, Australia

Phone: +61 2 9265 0700

Fax: +61 2 9267 5443

Email: [apsadconference@arinex.com.au]apsadconference@arinex.com.au

Website: [www.apsadconference.com.au]www.apsadconference.com.au

APSAD Conference 2015 Oral Presentation Acceptance

APSAD Secretariat <apsadconference@ashm.org.au>

Fri 24/07/2015 12:10

To: Kim Caudwell <kim.caudwell@postgrad.curtin.edu.au>;

Dear Kim,

Thank you submitting an abstract for the APSAD Annual Scientific Alcohol and Drug Conference 2015.

We are delighted to advise you that your paper has been selected for an Oral Presentation (15 minutes duration, including questions/discussion). Please see details below:

Submission ID: 047

Submission Title: Predicting Pre-Drinking in Australian Undergraduate Students: Applying an Integrated Model of Behaviour

If you are not the person presenting, please ensure that you pass this information onto the presenter so they can complete the necessary information. Please also notify the conference at apsadconference@ashm.org.au

Presentations must be owned by the author presenting.

Each presenter MUST action all the items below by the due dates or risk being removed from the Conference Program.

Action	Due Date
Confirmation of Oral Presentation emailed to apsadconference@ashm.org.au	7 August
Register for the Conference	28 August
Conference Presentation & Consent Form including disclosure slide (onsite)	min 4 hours before presenting

Speaker who fail to submit the required items, including Speaker Registration, by the due date risk being removed from the program at the discretion of the Conference Organising Committee. Please note registration cancellation fees will apply.

Presenter Confirmation Due Date: Friday 7 August 2015

All speakers are required to confirm they will be presenting their abstract in the allocated slot. Please advise apsadconference@ashm.org.au if you are not able to. It would be appreciated if an alternative could be sourced to present your paper wherever possible.

Speaker Registration Due Date: Friday 28 August 2015

All speakers are required to be registered to attend the Conference, you are able to register via the Conference website: www.apsadconference.com.au

Cancellations & Substitutions

Please avoid late cancellations or substitutions as marketing material including the conference handbook will be pre-printed and cannot be removed at a later date. If you need to cancel or substitute presenters please inform the Conference Secretariat at apsadconference@ashm.org.au

Presentation Details

The details of the presentation you have been selected for are listed at the beginning of this emails. Please note your presentation may fall on any day of the Conference and you will be notified closer to the event date. The committee for the Conference recognises the considerable contribution that industry partners make to professional and research activities. We also recognise the need for transparency

of disclosure of potential conflicts of interest by acknowledging these relationships in publications and presentations. You will be required to insert into your presentation a disclosure of interest slide. This will be checked when loading presentations in the speaker preparation room.

AV Requirements

Your presentations should be created and presented in PowerPoint. Each Conference room will be equipped with data projection facilities, lectern, microphone and a laser pointer. An audio visual operator in the room will control the presentation, lights and audio and will be able to assist you with any questions on the day. Please ensure your presentation is brought to the Conference on a USB Stick for uploading by a professional AV technician at the dedicated speaker preparation room.

Privacy and Media - Please read this information carefully - you will be asked onsite whether you consent to the following activities:

Privacy

Allow your PowerPoint to be displayed on the Conference website. Speaker presentations will be published on the conference website post conference (unless specified otherwise). We require all speakers to provide permission for their PowerPoint presentations to be published. All presenters will be given the opportunity to submit a revised PowerPoint for publication on the website.

Media

As part of the the conference we will be promoting the program and speakers through social media and conventional media channels. Please help us by letting us know:

- If you or your institution have a twitter identity or hashtag we should refer to
- Any web links to information relating to you or the abstract you submitted that we could use to promote your work
- If you do NOT want your abstract to be available for viewing on the APSAD website
- If you do NOT wish your abstract to be made available to media

The media embargo for all data and information from abstracts or presentations is the start date of the conference unless indicated otherwise. Information in materials distributed to the media in advance is embargoed until the start of the conference. We kindly request that all media co-operate with this policy.

Disclaimer

Acceptance of your abstract does not constitute an offer to pay travel, accommodation or registration costs. Similarly, no speaker's fee is paid to proffered paper presenters.

We look forward to your participation in the APSAD Annual Scientific Alcohol and Drug Conference 2015. Please contact the Secretariat if you have any questions.

Kind regards,

APSAD Conference Secretariat
Email: apsadconference@ashm.org.au
Phone: +61 2 8204 0770

Regarding your INEBRIA abstract submission

Shannon Murray <inebria2015@gmail.com>

Sat 20/06/2015 03:22

Inbox

To:

Kim Caudwell <kim.caudwell@postgrad.curtin.edu.au>;

Cc:inebria

<

 1 attachments (16 KB)

INEBRIA 2015 Abstracts Accepted.xlsx;

Good Day:

We are pleased to inform you that your abstract(s) has been accepted for presentation to the 12th INEBRIA Conference by our Scientific Committee. In the file attached you'll find the list of abstracts accepted. Please review it and let us know if everything is correct.

Please remember that all authors are encouraged to register for the conference. Authors of accepted abstracts will be able to register with a reduced fee, which is clearly marked on the registration form. Register here: <http://www.planetreg.com/INEBRIAConf2015>

Please contact our team with any questions.

Shannon Murray
INEBRIA 12th Congress Planning Member
478.633.5910
478.633.5575 fax
www.inebria.net

Every reasonable effort has been made to acknowledge the owners of copyright material. I would be pleased to hear from any copyright owner who has been omitted or incorrectly acknowledged.